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COP4 SUBMISSION REGARDING NON-MERCURY ALTERNATIVES TO DENTAL AMALGAM

The International Academy of Oral Medicine and Toxicology (IAOMT) agrees with the Minamata Convention on Mercury that it is time to make mercury history, and we are pleased to have the opportunity to offer this submission regarding non-mercury alternatives to dental amalgam. In this report, we provide information related to the availability, technical and economic feasibility and environmental and health risks and benefits of the non-mercury alternatives to dental amalgam, as requested by the Secretariat.

About the IAOMT

The International Academy of Oral Medicine and Toxicology (IAOMT, www.iaomt.org) is proud to be an accredited member of the United Nations Environment Programme (UNEP)'s Global Mercury Partnership, having participated in the meetings, intercessional work, and negotiations relevant to the Minamata Convention on Mercury. The IAOMT is a non-profit organization and a global network of over 1,200 medical, dental and research professionals. We have been dedicated to protecting public health and the environment by assessing the risks of dental mercury since we were founded in 1984. Our [Safe Mercury Amalgam Removal Technique \(SMART\)](#) has been recognized in [peer-reviewed scientific literature](#).

Background on Dental Amalgam

Controversy has surrounded the use of mercury in dentistry since the 1800's, when the hazardous material was first widely introduced as a filling component. The American Society of Dental Surgeons, the predecessor to the American Dental Association (ADA), made its members pledge not to use mercury because of its known toxicity,¹ and as you know, in more recent years, government officials, scientists, dentists, consumers, and many others have raised serious concerns about the threats dental mercury poses to humans and to the environment at large.

Now we know better because scientific literature shows the health hazards of using dental mercury. Although the use of dental mercury amalgam fillings has reportedly been decreasing in developing countries,² the results of a survey published in 2017 in the *Journal of Public Health Dentistry* suggested that 62% of general dentists and 56% of pediatric dentists in the U.S. were still using dental mercury amalgam.³ Additionally, it is recognized that billions of people already have dental amalgam fillings in their mouths.⁴

Alternatives to Dental Amalgam

In the past, a common argument against composite fillings was that they were not as durable as amalgam. However, recent studies have debunked this claim. Researchers of a study which was published in 2016 and conducted on over 75,000 patients for over ten years found that posterior amalgam fillings had a *higher* annual failure rate than composites.⁵ Two separate studies published in 2013 likewise found that composite fillings performed as well as amalgam when comparing failure rates⁶ and replacement filling rates.⁷ Other research has offered similar findings, including the following examples:

- A study about the longevity of composite fillings published in 2017 and authored by researchers at the University of Pittsburgh School of Dental Medicine concluded that composites can replace amalgam restorations.⁸
- A study published in 2015 documented “good clinical performance” of composite resins over a 30-year evaluation.⁹
- A meta-analysis published in 2014 noted “good survival” of posterior resin composite restorations.¹⁰
- A study published in 2011 found “good clinical performance” of composites over a 22-year period.¹¹

Research has further confirmed that composite resins present a lower risk for chemical exposures. In a 2016 publication co-authored by risk assessment specialist Dr. G. Mark Richardson, it was reported: “Relative risks of chemical exposures from dental materials decrease in the following order: Amalgam>Au alloys>ceramics>composite resins.”¹²

As far as considering the costs of implementing these recommendations, in a report entitled “[The Economics of Dental Amalgam Regulation](#),” the authors noted that amalgam use is already declining and that restrictions on mercury are inevitable.¹³ The authors concluded, “We can then make the case that the overall health care expenditures necessary to deal with diseases and conditions, known or unknown, arising from the continued installation of amalgam could far exceed the relatively manageable cost increases to the consumer for the alternatives... This is not to mention the cost...of lost work time owing to concomitant illness and disability.”¹⁴

Additionally, the IAOMT co-released a [2012 report from Concorde](#) of Brussels, Belgium, which noted: “In order to obtain a useful perspective on the ‘external’ costs to society that are not included in the fees a dental patient pays the practitioner, we have examined 1) the costs of keeping dental mercury releases from being released into the environment, and 2) when dental mercury is no longer released into the environment, the various benefits accrued to human health and society. ...[W]hichever analytical approach one chooses, even when using conservative assumptions, and even allowing for the uncertainties inherent in much of the cost data, it is clear that the real cost of using amalgam far outweighs the cost of using mercury-free composite...”¹⁵

Health Risks of Dental Mercury

The health risks of continuing to use dental mercury undeniably outweigh any and all excuses not to use existing alternatives. Mercury particulate can be discharged from dental amalgam fillings, and mercury vapor is continuously emitted from dental mercury amalgam fillings,^{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} which means that people are directly exposed to mercury as a result of their dental mercury amalgam fillings. The output of mercury is intensified by the number of amalgam fillings in the mouth^{42 43 44 45 46 47 48 49 50} and/or the number of amalgam surfaces in the mouth,^{51 52 53 54 55 56 57 58 59 60 61 62} the type of the amalgam filling (i.e. specific content of metals),^{63 64} and other factors such as chewing, teeth-grinding, brushing, dental treatments and procedures, and the consumption of hot liquids.^{65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84} Mercury is also known to be released during the placement, replacement, and removal of dental mercury amalgam fillings.^{85 86 87 88 89 90 91 92 93 94 95 96 97 98 99}

Children

Fetal and infant exposure to mercury is known to have potentially serious health consequences, and the number of maternal amalgam fillings has been associated with mercury levels in cord blood;^{100 101 102} in the placenta;¹⁰³ in the kidneys^{104 105} and liver¹⁰⁶ of fetuses; in fetal hair;^{107 108} and in the brain¹⁰⁹ and kidneys¹¹⁰ of infants. Additionally, mercury is excreted in breast milk of mothers with dental mercury amalgam fillings, and the mercury concentration in breast milk increases as the number of amalgam fillings in the mother increases.^{111 112 113 114} Significantly, a study published in 2018 by researchers in Norway involved over 72,000 pregnant women with data on the number of teeth containing dental amalgam fillings. The researchers discovered a “statistically significant association between the number of teeth filled with dental amalgam and the risk of perinatal death.”¹¹⁵

Scientific research continues to show that children are at-risk for health impairments potentially caused by dental amalgam mercury fillings.^{116 117 118 119 120 121 122 123 124 125} In summary, authors of a study from 2011 cautioned: “Changes in dental practices involving amalgam, especially for children, are highly recommended in order to avoid unnecessary exposure to Hg [mercury].”¹²⁶

Occupational

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.¹²⁷ 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,^{128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163} and dental students.^{164 165 166} Another area that has received attention is the possibility of reproductive hazards to female dental personnel, including menstrual cycle disorders, fertility issues, and pregnancy risks.^{167 168 169 170 171 172 173 174}

Dental workers require protection from mercury exposures when working with 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.^{175 176 177 178 179 180 181 182 183 184 185 186}

187 188 189 190 191 192 193 194 195 Significantly, research published in 2019 in the peer-reviewed *Journal of Occupational Medicine and Toxicology (JOMT)* showed that the safety thresholds for mercury exposure can be exceeded during dental procedures involving drilling on amalgam fillings if special precautions are not in place.¹⁹⁶ The researchers emphasized that specific safety measures can mitigate these mercury levels and provide more rigorous protection for patients and dental workers. More on the importance of safety measures is provided in the [IAOMT's Safe Mercury Amalgam Removal Technique \(SMART\)](#).

General population

80% of the mercury vapor emitted from dental amalgam is absorbed by the lungs and passed to the rest of the body.¹⁹⁷ In research published in 2011, Dr. G. Mark Richardson reported that more than 67 million Americans aged two years and older exceed the intake of mercury vapor considered “safe” by the U.S. EPA due to the presence of dental mercury amalgam fillings, whereas over 122 million Americans exceed the intake of mercury vapor considered “safe” by the California EPA.¹⁹⁸

Properly diagnosing “adverse health effects” related to dental mercury amalgam fillings is impeded by the intricate list of potential responses to the elemental form of the substance, which include over 250 specific symptoms.¹⁹⁹ One reason for the wide-range of symptoms is that mercury taken into the body can accumulate in virtually any organ.

The association of genetic predisposition with specific, adverse effects from mercury exposure has been examined in several studies. It has been found that mercury exposure from dental mercury amalgam particularly threatens individuals with genetic variants that can impact their response to mercury exposures such as those with CPOX4,^{200 201 202} APOE(3,4),^{203 204 205 206} and BDNF (brain-derived neurotropic factor) polymorphisms.^{207 208 209} For example, the researchers of a study published in 2006 linked the polymorphism CPOX4 (coproporphyrinogen oxidase, exon 4) to decreased visuomotor speed and indicators of depression in dental professionals.²¹⁰ Furthermore, the CPOX4 genetic variation was identified as a factor for neurobehavioral issues in a study of children with dental amalgams. The researchers noted, “...among boys, numerous significant interaction effects between CPOX4 and Hg [mercury] were observed spanning all 5 domains of neurobehavioral performance...These findings are the first to demonstrate genetic susceptibility to the adverse neurobehavioral effects of Hg [mercury] exposure in children.”²¹¹

Other than CPOX4, APOE, and BDNF polymorphisms, genetic traits that have been examined for association with health impairments caused by mercury exposure include metallothionein (MT) polymorphisms,^{212 213} catechol-O-methyltransferase (COMT) variants,²¹⁴ PON1 variants,^{215 216} MTHFR mutations and other genetic aspects.^{217 218 219} The authors of one of these studies concluded: “It is possible that elemental mercury may follow the history of lead, eventually being considered a neurotoxin at extremely low levels.”²²⁰

Mercury Allergies

In some genetically susceptible individuals, metals can also induce allergies.²²¹ A study published in 2018 in the journal *Dermatitis* was conducted on 686 adults who were patch tested for allergies. The results demonstrated that “38.9% of patients had 1 or more positive patch-test reactions to a metal allergen, most commonly nickel (17.4%), mercury (12.3%), and palladium

(9.2%)...Among patients with positive reactions to nickel, 34.5%, 15.1%, and 5.0% had positive reactions to 1, 2, or 3 additional metals, respectively.”²²² That study involved individuals with suspected allergies; however, the statistics are relevant, as studies involving the general population and the prevalence of metal allergies are rare.²²³ However, a 1993 study reported that 3.9% of healthy subjects tested positive for metal reactions in general.²²⁴ If this figure is applied to the current U.S. population, this would mean that dental metal allergies potentially impact as many as 12.5 million Americans.

The number of affected individuals is likely much higher, though, because recent studies and reports tend to agree that metal allergies are on the rise.^{225 226} Part of this could be caused by increased exposure to metals, including ear/body piercings, because exposure to metals has been cited as a potential trigger for the development of allergies to them.²²⁷ Additionally, it has been hypothesized that contact with metals during an infection could increase chances of developing a metal allergy later in life.²²⁸

An issue is the wide-range of symptoms patients allergic to dental metals can exhibit. In a 2014 publication, Dr. Vera Stejskal wrote: “Metal-induced inflammation may be involved in the pathology of various autoimmune and allergic diseases, where abnormal fatigue, joint and muscle pain, cognitive impairment and other non-specific symptoms are often present.”²²⁹ Additionally, a gamut of health conditions has been linked to dental metal allergies, including autoimmunity,^{230 231} chronic fatigue syndrome,^{232 233 234} fibromyalgia,^{235 236} metallic pigmentation,²³⁷ multiple chemical sensitivities,^{238 239} multiple sclerosis,²⁴⁰ myalgic encephalitis,²⁴¹ oral lichenoid lesions,^{242 243 244 245 246} orofacial granulomatosis,²⁴⁷ and even infertility in both women and men.²⁴⁸

Conclusion

The Precautionary Principle is essential to consider when evaluating the research described above and the request by the Secretariat of the Parties and others to collect information pursuant to paragraph 7, Article 4 of the Convention (i.e. information related to the availability, technical and economic feasibility and environmental and health risks and benefits of the non-mercury alternatives to amalgam).

As you know, in June 1992, the United Nations Environment Programme ratified the [Rio Declaration on Environment and Development](#), which, among other principles, established the precautionary approach among UNEP member states. In particular, Principle 15 states: “In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”²⁴⁹

Further to the Rio Declaration, in January 1998, at an international conference involving scientists, lawyers, policy makers, and environmentalists from the United States, Canada and Europe, a formalized statement was signed and became known as the “[Wingspread Statement on the Precautionary Principle](#).”

In it, the following advice is given: “When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context the proponent of an activity, rather than the public, should bear the burden of proof.”²⁵⁰

Based on scientific evidence, concepts of risk assessment, and the precautionary principle, it is our position that it is urgent to phase-out dental mercury amalgam fillings. All of us should be seriously concerned that dental mercury amalgam fillings are following the same delayed route to safety regulations as occurred with cigarettes and lead-based paint.

The Minamata Convention was created to protect human health and the environment from the adverse effects of mercury. So, when will dental mercury end? Is it time to make more excuses? Or is it time to make mercury history?

Let’s make mercury history together and end dental mercury now.

Sincerely,
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