

Information on non-mercury alternatives to dental amalgam in Canada

Non-mercury alternatives to dental amalgam are widely used in Canadian dental practices. Most commonly, composite resins are used in place of dental amalgam for tooth restorations. Two of the largest Canadian dental suppliers estimate that sales of composite filling material have steadily increased over time while sales of dental amalgam have decreased. Today, it is estimated that over 90% of sales of filling material in Canada are composite resin and less than 10% are dental amalgam.¹ The increase in frequency of use of non-mercury restoration materials is also reflected by imports of dental amalgam which have declined drastically over the last 12 years.²

Nonetheless, there are still situations where composite resins, glass ionomers and other non-mercury alternatives to dental amalgam are not suitable or available for use due to technical, economic, and/or health reasons. Non-mercury alternatives to dental amalgam have been shown to have higher rates of failure and secondary caries and so must be replaced more frequently than amalgam restorations.³ It is for this reason that non-mercury alternatives to dental amalgam may not be suitable for certain individuals or populations; particularly for those with a high frequency of caries and poor oral hygiene or for those for whom regular dental visits are unavailable.^{4,5} Financial and physical access to dental care remains a barrier for vulnerable groups including: remote communities, Indigenous peoples, refugees and immigrants, people with disabilities, elderly people, and low-income Canadians.⁶

Restorations performed with non-mercury materials are generally more expensive than dental amalgam in Canada (about \$171 for amalgam compared to \$219 for composite) and do not last as long (11.5 year lifespan for amalgam compared to 8 year lifespan for composite).⁷ The higher costs of placement as well as the need to replace composite fillings more frequently is an important consideration for the discussion on the availability and economic feasibility of non-mercury alternatives to dental amalgam. About 94% of dental care in Canada is provided by the private sector, but 32% of Canadians do not have dental insurance and pay the total cost of dental visits out-of-pocket.^{8,9} Even with dental insurance, there are typically costs associated with visits as insurers only cover a portion of dental fees.¹⁰ The use of dental care services in Canada is largely influenced by insurance coverage and the ability to pay out-of-pocket for the expenses. Over six million Canadians (or about one in five) avoid dental visits each year because of the cost.^{11, 12}

In addition to the concerns about the affordability of dental care for individuals, the cost differential between composite fillings and amalgam fillings can have real financial implications on the sustainability and effectiveness of publicly funded oral health programs which have the goal of providing low cost or no cost dental care to vulnerable populations. Increased operational costs to these programs mean that fewer patients can be treated. Poor oral health can lead to impaired physical health, low self-esteem, increased absences and poor performance at school or work.¹³ The health risks from untreated caries are much higher than the risks from dental restorations, regardless of their material.

In discussing the economic feasibility of non-mercury alternatives to dental amalgam, it is important to consider the cost implications of using more expensive non-mercury restoration materials in the broader context of overall health and accessibility of dental care, for both publicly funded programs as well as individuals. It can be difficult to justify the use of higher costing non-mercury alternatives over dental amalgam when there are no known adverse health risks of dental amalgam, and the environmental risks can be managed using best practices and technologies.

In Canada, access to dental care can also be limited by physical distance. For example, the Inuit Oral Health Survey conducted in 2008-2009 found that fewer than half of the study participants received dental care in the past year, even though few reported that costs were a factor in their decision.¹⁴ For Inuit and other First Nations groups, the federal government provides some health and dental insurance. However, many Inuit and remote communities do not have a resident dentist and rely on irregular visits from fly-in dentists who reside in southern Canada. Often only the most serious cases can be seen due to time limitations, otherwise people must be flown in and out of the community for treatment and dental emergencies.¹⁵ The issues of access to care shown in this example applies to other remote and Indigenous communities in Canada who do not have resident dentists. Non-mercury alternatives to dental amalgam are not always the best choice for restorations in these situations because they do not have the same strength and longevity of dental amalgam, resulting in more frequent replacements.

In terms of the health risks of non-mercury alternatives to dental amalgam, concerns have been raised about the safety of composite resins as restoration materials because many composite resin materials contain BPA derivatives, most commonly bisphenol A glycidyl methacrylate (Bis-GMA; CAS no. 1565-94-2), bisphenol A ethoxylate dimethacrylate (Bis-EMA, CAS no. 41637-38-1), and bisphenol A dimethacrylate (Bis-DMA; CAS no. 3253-39-2).^{16,17} A number of studies have shown that several substances, including BPA, can leak from some composite filling materials.^{18,19} However, in 2010 the World Health Organization concluded that dental materials were unlikely to be an important source of BPA exposure to humans and likened the exposure risks from composite resins to food packaging and drink containers.²⁰ A subsequent assessment conducted by the European Food Safety Authority agreed with this conclusion.²¹

The Canadian Health Measures Survey (CHMS) is Canada's national human biomonitoring program. Cycle 8 of the CHMS (2022-2023) will collect information to allow the further evaluation the human health risks of BPA and its derivatives from composite fillings and other potential sources of exposure. This program will collect biospecimens from approximately 6,700 Canadians aged 1 to 79 as well as record the number of tooth surfaces with either composite resin or amalgam. Information on participants' diets, lifestyle and occupation will also be collected to investigate additional potential exposure pathways.

Recently, the Canadian Agency for Drugs and Technologies in Health (an independent non-governmental research and consulting organization) collected and analyzed scientific literature focused on health outcomes for patients treated with either dental amalgam or composite resins. The report found that studies describing renal effects, physical development and neuropsychological and psychosocial outcomes had few statistically significant differences with groups of people treated with one filling material over another and that the minor differences identified varied by favouring either composite resin or dental amalgam with no clear pattern.²² The report also found that no papers produced statistically significant differences observed between treatment groups in terms of neurological symptoms and immune function. The authors of the report noted that in all of the studies reviewed, there was a high risk of performance bias because both the participants and the clinicians placing the restorations were aware of the type of restoration that was placed.

The environmental risks of non-mercury alternatives to dental amalgam have not been well studied. Part of the difficulty in quantifying the risk to the environment is that there are many formulations of

composite material and their chemical compositions are often proprietary.²³ This poses a challenge to assess the environmental risks of the substances used both individually and as mixtures. For example, BPA is used as a raw material to synthesize resin monomers that are used in composite fillings; however there is limited information about how much BPA enters the environment as a result of the manufacture, use, and disposal of composite fillings.²⁴ The lack of information on non-mercury alternatives does not allow for a robust environmental risk assessment to be performed.^{25,26,27} Unlike dental amalgam, there are no separators, chairside traps or special disposal protocols for waste consisting of composite materials, meaning the majority of composite waste material is ultimately deposited in municipal wastewater systems or landfills.²⁸

The creation of microparticulates (including microplastics) and nanoparticles during the filing and shaping, CAD/CAM milling, and removal of composite fillings are an additional consideration in discussing the environmental risks of non-mercury filling materials. Microplastics have been found to be persistent in the environment and are present in many organisms including birds, fish, turtles, and invertebrates.²⁹ Micro and nanoparticles created from dental practices are most often discharged into wastewater systems.³⁰ Despite a high rate of removal of microplastics by wastewater treatment plants, given the large volumes of water processed, effluent from wastewater treatment plants has been identified as an important pathway for the entry of microplastics into water.³¹ The contributions of dental materials to BPA and micro/nanoparticulate concentrations in landfills and wastewater are unknown and may warrant further investigation.³²

In summary, non-mercury restorative materials are being used for the large majority of fillings in Canada. However, there are some circumstances where their use is not in the best interest of the patient due to technical and/or economic factors. Current evidence suggests there are no significant health risks from non-mercury restorative materials; however, research is ongoing. The potential impacts of non-mercury restorative materials have not been fully assessed, making it difficult to describe their environmental risks and benefits.

¹ Personal communication from the two largest dental supply companies in Canada.

² Government of Canada. 2019. Products Containing Mercury Regulations 2016 summary report: key results

³ Canadian Agency for Drugs and Technologies in Health (CADTH). 2018. Composite resin versus amalgam for dental restorations: a health technology assessment.

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⁶ Canadian Academy of Health Sciences. 2014. Improving access to oral health care for vulnerable people living in Canada.

⁷ Canadian Agency for Drugs and Technologies in Health (CADTH). 2018. Composite resin versus amalgam for dental restorations: a health technology assessment.

⁸ Canadian Academy of Health Sciences. 2014. Improving access to oral health care for vulnerable people living in Canada.

⁹ Canadian Dental Association. 2018. State of Oral health in Canada.

¹⁰ Blomqvist A, Woolley F. Filling the Cavities: Improving the Efficiency and Equity of Canada's Dental Care System. C.D. Howe Institute 2018 Commentary No 510

¹¹ Canadian Academy of Health Sciences. 2014. Improving access to oral health care for vulnerable people living in Canada.

¹² Statistics Canada. 2019. Health Fact Sheets: Dental Care, 2018.

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- ²⁴ Canadian Agency for Drugs and Technologies in Health (CADTH). 2018. Composite resin versus amalgam for dental restorations: a health technology assessment.
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- ³² UNEP/MC/COP.3/INF/25