Prevention and treatment of dental caries with mercury-free products and minimal intervention

WHO oral health briefing note series

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ISBN 978-92-4-004618-4 (electronic version)
ISBN 978-92-4-004619-1 (print version)

Suggested citation. Prevention and treatment of dental caries with mercury-free products and minimal intervention: WHO oral health briefing note series. Geneva: World Health Organization; 2022. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps.who.int/iris.

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Acknowledgements

The World Health Organization (WHO) is grateful to all those who contributed to this oral health briefing note series.

Benoit Varenne, Dental Officer, Oral Health Programme, WHO Noncommunicable Diseases Department, provided overall direction and supervision of preparation of the document in collaboration with Nicole Rendell, Technical Officer, Oral Health Programme, WHO Noncommunicable Diseases Department and with the technical support of Gampo Dorji and Ratnasabapathipillai Kesavan, (WHO Regional Office for South-East Asia), Huda Abdul Ghaffar (WHO Regional Office for the Eastern Mediterranean), Yuriko Harada (WHO Regional Office for the Western Pacific), Carolina Hommes (WHO Regional Office for the Americas) and Yuka Makino (WHO Regional Office for Africa). The lead writer was Mary Plummer, WHO consultant.

Thanks are also due to the following for their review of the content: Habib Benzian and Richard Niederman (WHO Collaborating Centre for Quality-Improvement & Evidence-Based Dentistry, New York University, United States of America), Jaime Aparecido Cury (University of Campinas, Brazil), Ritu Duggal (WHO Collaborating Centre for Oral Health Promotion, All India Institute of Medical Sciences, India), Carlos Alberto Feldens (Lutheran University of Brazil, Brazil), Jo Frencken (Radboud University, The Netherlands), Mairead Harding, (University College Cork, Ireland), Edward Lo and Duangthip Duangporn, (University of Hong Kong, China), Prathip Phantumvanit (Thammasat University, Thailand), Derek Richards (Centre for Evidence-based Dentistry, United Kingdom of Great Britain and Northern Ireland), Pisol Senawongse (WHO Collaborating Centre for Oral Health Education and Research, Mahidol University, Thailand).

Funding source: funds received from the WHO voluntary contributions from The Borrow Foundation, United Kingdom.

Background information

This WHO oral health briefing note series focuses on prevention and treatment of dental caries (tooth decay) with mercury-free products and minimal interventions. Dental caries is a major public health problem globally as the disease affects all age groups, with an onset in early childhood and continued increase over the life course. This first section explains why mercury-free materials and products and minimally invasive interventions are important. The following sections describe six essential strategies using mercury-free products and minimally invasive intervention approaches to prevent and treat dental caries: fluoride toothpaste, fluoride varnish, glass ionomer cement sealants, glass ionomer cement restorations, silver diamine fluoride and composite resin restorations.

1. What is dental caries?

- Dental caries (hereafter referred to as "caries") is tooth decay that results when free sugars contained in food or drink are converted by bacteria into acids that destroy a tooth over time. Free sugars are all sugars added to foods by the manufacturer, cook or consumer, plus sugars that are naturally present in honey, syrups and fruit juices. Tooth decay can lead to cavities, which are permanently damaged areas in the hard surface of the teeth that develop into openings or holes *(1, 2)*.
- Caries is mostly preventable, but nonetheless it is the most common noncommunicable disease globally. Caries is a disease across the life course and affects all age groups *(1)*. It is estimated that 2.3 billion people suffer from caries of permanent teeth and more than 530 million children suffer from caries of primary teeth *(3, 4)*.
- Caries remains largely untreated and has a very unequal distribution globally. Within and between countries, vulnerable and marginalized populations have low access to caries prevention and treatment services, especially in low- and middle-income countries *(4)*.
- Caries has negative impacts. Early stages of caries are often without symptoms, while advanced stages of caries may lead to pain, infections and abscesses, or even sepsis. Also, caries links with anxiety and reduced quality of life as well as absenteeism from school and workplaces. Caries is among the main reasons for hospitalization of children in some high-income countries *(1, 4–6)*.

2. Why use mercury-free products to prevent and treat caries?

- WHO considers mercury to be one of the top 10 chemicals or groups of chemicals of major public health and environmental concern. People are mainly exposed to methylmercury, an organic compound, when they eat fish and shellfish that contain it and through worker inhalation of elemental mercury vapors during industrial processes *(7)*.
- Dental amalgam, which contains 50% mercury, has been commonly used as a restorative material to fill cavities caused by caries. Mercury pollution from dental amalgam is often the largest source of mercury in municipal wastewater. Mercury enters the soil via wastewater sludge, land disposal and the burial of deceased persons with dental amalgam fillings. It enters the air from incineration of deceased persons with amalgam fillings in crematoria *(8)*.
- The Minamata Convention on Mercury is a global treaty that aims to protect human health and the environment from emissions and releases of mercury and mercury compounds *(9, 10)*.
- Annex A Part II of the Minamata Convention on Mercury outlines the provision that, to phase down the use of dental amalgam, a country that is Party to the Convention shall implement two or more of nine measures. This should take into account the Party's domestic circumstances and relevant international guidance.
- As part of such measures, the Minamata Convention recommends the use of cost-effective and clinically effective mercury-free products for dental restoration *(9)*. Some of these materials have an added benefit of caries prevention through the slow release of fluoride *(11)*.

3. Why use minimally invasive intervention approaches to prevent and treat caries?

- Minimal intervention restorations preserve as much of the natural tooth as possible, making this method potentially beneficial to the lifelong health of all patients. Minimal intervention approaches include atraumatic restorative treatment (ART), which involves removing tooth decay using hand instruments alone and filling the cavity with an adhesive dental material, such as glass ionomer cement. ART causes minimal tissue loss because the shape of the carious lesion defines the cavity *(11–15)*. However, ART can only be used to treat cavities that are accessible.
- Minimally invasive intervention approaches avoid unnecessary pain, infection and permanent damage to teeth while preventing and treating caries *(11, 12, 14–16)*. Minimally invasive interventions also generate few or no aerosols, which is particularly beneficial when there is concern about possible airborne transmission of illness, such as during the COVID-19 pandemic *(17)*.
- Minimally invasive intervention approaches emphasize the importance of upstream primary prevention of caries. Upstream measures can include taxation of products containing free sugars, policies limiting sugar advertising and implementation of clear nutrition labelling as well as family education to reduce consumption of free sugars *(1)*.
- Minimally invasive interventions may also include secondary prevention, such as application of fluoride varnish, glass ionomer cement sealant or silver diamine fluoride application *(18)*.
- Conventional dental restorations involve an electric drill to clear away decayed areas of a tooth. Typically, a conventional restoration also removes healthy tooth tissue to make filling placement easier *(12, 14–16)*. The resulting cavity is filled with a dental material like dental amalgam or composite resin.
- Minimally invasive intervention techniques generally are faster and require fewer resources and training than conventional methods. Minimally invasive intervention techniques cannot entirely replace conventional approaches, but in high-, middle- and low-resource oral health care settings and settings other than health facilities, such as preschools, day-care facilities, schools, ambulatory care, and retirement residencies, care is simplified, thereby reducing care time, increasing access and reducing costs *(14, 15, 19, 20)*.