



*'The decision to place the first restoration in a previously unrestored surface of a tooth is a crucial event in the life of a tooth, because a permanent restoration in the true sense of the term 'permanent' does not exist.'*

*-IA Mjor and HM Ericson JADA 2008 139 (5): 565-570*

## ***Mercury free 21<sup>st</sup> century dentistry in developing economies- the time for action is now.***

*Availability, Technically feasibility, Economical feasibility,  
Environmental advantages and Health advantages of Non-mercury  
alternatives for developing economies.*

***Official Publication of Dentists' Committee For A Mercury Free Africa***  
*An Affiliate of World Alliance For A Mercury Free World*



1<sup>st</sup> floor, 19 Ogunlana Drive, Obele bus stop, Surulere, Lagos, 08037520961 / 08096312022

[mercuryfreedentists.africa@gmail.com](mailto:mercuryfreedentists.africa@gmail.com) // [www.mercuryfreedentistsafrica.org/](http://www.mercuryfreedentistsafrica.org/)

## About Dental Caries

Dental caries is one of the most prevalent diseases with 91% of adults experiencing caries in their lifetime. It has been estimated that 40% of children have tooth decay by the time they reach kindergarten. (Beltran-Aguilar ED, Barker LK, Canto MT, et al 2002; Bentley I P. 2007).

Dental caries is a biofilm-mediated, sugar-driven, multifactorial, dynamic disease that results in phasic demineralization and remineralization of dental hard tissues. It is a complex biofilm disease which changes dynamically with its environment and the local chemistry of the tooth site, pellicle and saliva. (Pitts NB, Zero DT, Marsh PD, Ekstrand K et al: 2017)

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# What is 21<sup>st</sup> century dentistry?

*21<sup>st</sup> century dentistry is mercury free.*

*21<sup>st</sup> century dentistry is minimum intervention dentistry.*

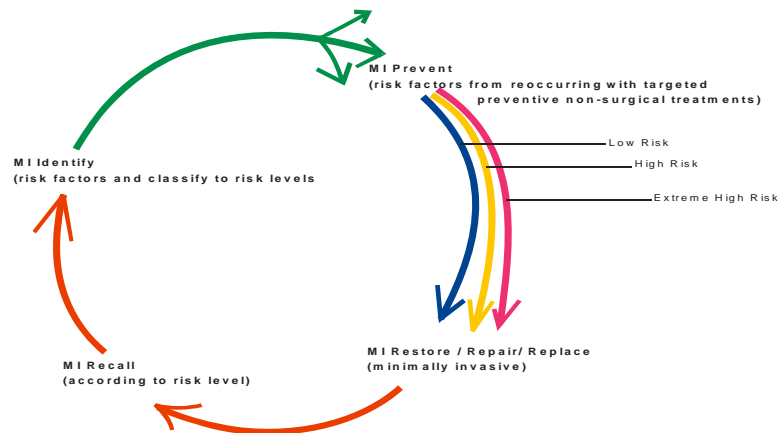
*What is Minimum Intervention Dentistry (MID)?*

Minimum intervention dentistry is a holistic, evidence based, patient centered, prevention-focused approach to management of tooth decay (dental caries). The ‘drill and fill’ approach of GV Black’s era (19<sup>th</sup> & 20<sup>th</sup> century dentistry ) did not control the disease but resulted in progressively larger and more complex cavities, increased costs to both patient and healthcare systems, loss of the tooth and poor oral health outcome. <sup>1, 2, 3</sup>

Research has shown that when diagnosed early tooth decay can be healed, arrested or re-mineralized by preventive non-restorative/non-surgical treatments. <sup>4</sup> This led to the emergence of MID as the new philosophy of managing tooth decay in the 21<sup>st</sup> century-minimum intervention dentistry (MID). <sup>5, 6, 7, 8</sup>

The cornerstone principles of 21<sup>st</sup> century dentistry (MID) includes early caries diagnosis and risk assessment, oral health promotion, targeted preventive non-restorative treatments, minimally invasive restorative treatments and frequent recalls to evaluate caries risk, caries control, and oral health outcome. <sup>9, 10, 11, 12</sup>

The goal of 21<sup>st</sup> century dentistry (MID) is to keep all teeth and oral tissues healthy and functional for life. <sup>13, 14</sup>



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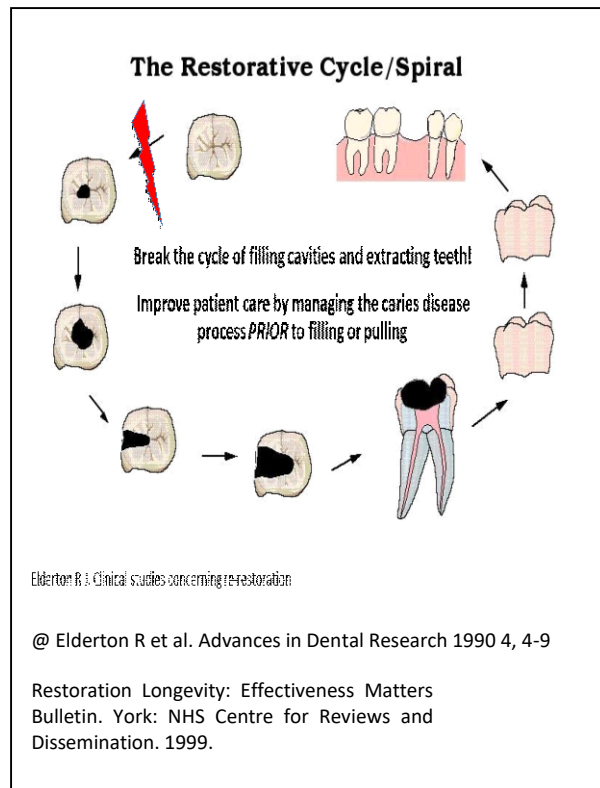
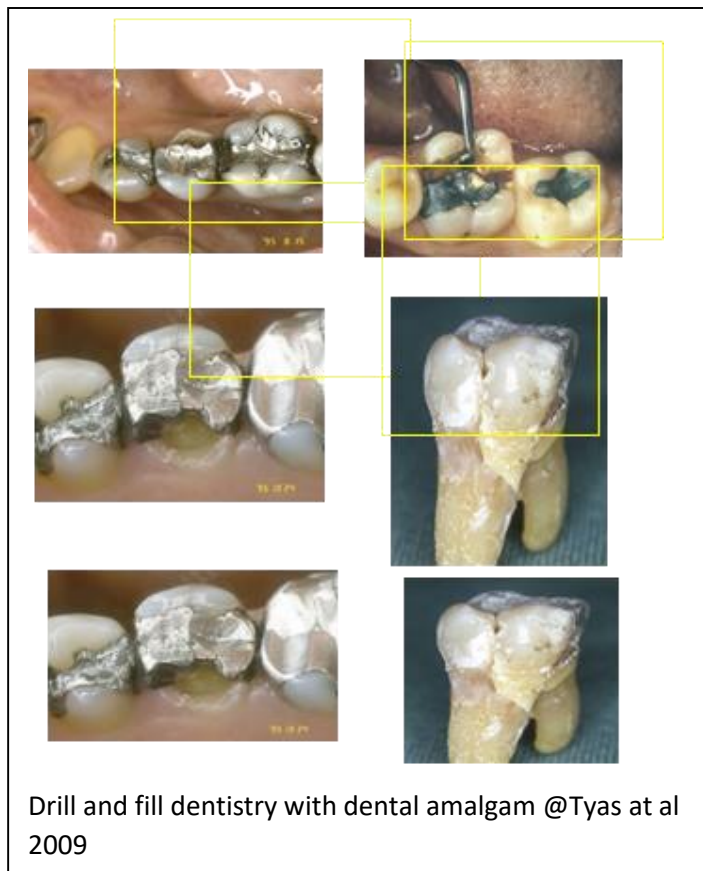


## What is 'Drill and Fill' (19<sup>th</sup> & 20<sup>th</sup> century) Dentistry?

'Drill and fill' dentistry is the old 19<sup>th</sup> and 20<sup>th</sup> century dentistry which treated the symptoms of tooth decay (cavity) rather than the causes of the disease. There is unnecessary removal of healthy tooth tissue to enhance the retention dental amalgam. <sup>1, 3, 13, 14</sup>

Recurrent decay at the margins of dental amalgam means there will be frequent repairs and further removal of healthy tooth tissues resulting in progressively larger and more complex restorations, weakened tooth structure, and eventual loss of the tooth with poor oral health outcome. <sup>15</sup>

Amalgam is an environmental and clinic pollutant because it is 41-50% mercury. Mercury is toxic to virtually all systems and organs in the human body. <sup>16, 17</sup> European scientists have labelled dental amalgam a secondary poison.



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08037520961 / 08096312022

## *What restorative material is ideal for 21<sup>st</sup> century dentistry?*

The goal of 21<sup>st</sup> century dentistry (MID) is to keep all teeth and other oral tissues healthy and functional for life as no restorative material can adequately replace the physical, chemical and biological characteristics of the natural tooth tissues (enamel and dentine).<sup>7, 12.</sup> The ideal 21<sup>st</sup> century restorative material must have the following characteristics:<sup>7, 18, 19,</sup>

- a. It must act as a reservoir for apatite forming ions (Fluoride, Calcium, Phosphate, and Strontium)
- b. It must be capable of ionic release of apatite forming ions to demineralized enamel and dentine; and
- c. It must have the ability to recharge apatite forming ions from saliva

The bio-activity of the restorative materials is more important than its compressive strength relative to that of enamel. Glass ionomer based restoratives have distinct advantages over other materials for MID because of their unique properties which include:<sup>7, 10, 18, 19</sup>

- i. Biocompatibility with residual dentine and enamel;
- ii. Hydrophilic properties- therefore they can be placed in the wet oral environment without the need for strict isolation/placement of a rubber dam (saliva is 99% water);
- iii. It chemically bonds to enamel and dentine (no etching with acids required);
- iv. It acts as ionic reservoir for apatite forming ions;
- v. It is capable of ionic exchange (of apatite forming ions) with demineralized dentine and enamel
- vi. It is capable of ionic recharge (of apatite ions ) from saliva; and
- vii. The restoration matures with time (increasing hardness) in the hydrophilic oral environment.

New bioactive hybrid long term tooth filling materials are being introduced by different manufacturers.<sup>18, 19, 20, 21,</sup>

Developing countries should reduce or remove import charges and taxes on glass ionomer based long term restoratives to ensure their widespread availability in order to ‘leapfrog’ into 21<sup>st</sup> century dentistry which is mercury free.<sup>22</sup>

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### ***Availability of non - mercury alternatives.***

*High viscosity glass ionomer restoratives are now widely available and affordable in developing economies. This is the material recommended by the World Health Organization (WHO) in the Basic Package for Oral Care manual. <sup>23</sup>*

*Different manufacturers now make high viscosity glass ionomer restoratives:*

1. GC CORPORATION-JAPAN <https://www.gceurope.com/products/> <sup>18</sup>
2. 3M ESPEE-USA [https://www.3m.com/3M/en\\_US/dental-us/](https://www.3m.com/3M/en_US/dental-us/) <sup>24</sup>
3. SHOFU-JAPAN <https://www.shofu.com/en/products/restoratives/> <sup>20</sup>
4. IVOCLAR VIVADENT - [www.ivoclarvivadent.com](http://www.ivoclarvivadent.com) <sup>25</sup>
5. VOCODENTAL-GERMANY - [www.voco.dental.us](http://www.voco.dental.us) <sup>21</sup>
6. SDI-Australia - [www.sdi.com.au](http://www.sdi.com.au) <sup>26</sup>
7. [www.dentsplysirona.com/en](http://www.dentsplysirona.com/en) <sup>27</sup>
8. ELEVATE ORAL CARE-US - [www.elevateoralcare.com](http://www.elevateoralcare.com) <sup>28</sup>
9. PULPDENT CORPORATION – USA <https://www.pulpdent.com/shop/category/a/> <sup>17</sup>
10. ADVANCED DENTAL SYSTEMS – UK <http://ahl.uk.com/index.php/products/amalomer> <sup>29</sup>
11. [www.i-dental.lt](http://www.i-dental.lt) <sup>30</sup>
12. [www.prevestdentpro.com](http://www.prevestdentpro.com) <sup>31</sup>

***Mercury free restoratives are now widely available. The prices will continue to come down as more dentists embrace the philosophy of minimum intervention dentistry (21<sup>st</sup> century dentistry) in managing dental caries; one of the most prevalent diseases to afflict mankind.***

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## ***Technical feasibility of non-mercury alternatives.***

The World Health Organization's recommendation for underserved communities is the Basic Package of Oral Care (BPOC) <sup>22</sup>

What is BPOC?

BPOC consists of:

i. Oral Urgent Treatment

Oral Urgent Treatment (OUT) is an on-demand service providing basic emergency oral care.

The three fundamental elements of OUT are:

- Relief of oral pain
- First aid for oral infections and dento-alveolar trauma
- Referral of complicated cases.

OUT can be provided by trained non-dentist personnel.

i. Affordable Fluoride Toothpaste

Use of Affordable Fluoride Tooth (AFT) is one of the most important preventive measures in managing tooth decay. However, fluoride toothpaste is often too expensive for disadvantaged groups in low- and middle-income countries to purchase.

Approaches to AFT aim at enabling everyone to clean teeth twice daily with quality fluoride toothpaste.

- i. Atraumatic Restorative (ART) is a caries management approach, consisting of a preventive (fissures sealant) and a restorative component (restoration). <sup>22</sup>
- ii. ART can be performed inside and outside a dental clinic, as it uses only hand instruments and a powder-liquid high-viscosity glass-ionomer restorative, and requires neither electricity nor running water. It is relatively painless, minimizing the need for local anesthesia and making cross-infection control easier.

It is noteworthy that the restorative material recommended for BPOC is high viscosity glass ionomer long term restoratives (e.g. Fuji IX GP, Amalomer etc.).<sup>22</sup>

Developing economies only need to remove all import duty and taxes on these biocompatible, pulp friendly and bioactive long term restorative materials in order to make them more affordable and widely available for oral healthcare in their underserved communities. <sup>32</sup>

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## ***Economic feasibility of non-mercury alternatives***

*Since BPOC with ART is recommended for developing economies by the WHO high viscosity glass ionomer restoratives have become widely available in most developing economies.*

*For example in Lagos, Nigeria we have had influx of high viscosity glass ionomer restoratives from India, China, Turkey and Lithuania. The price differential between these restoratives and dental amalgam has been narrowed with a progressive decrease in the percentage of restorations with dental amalgam from 57.5 percent between 2011 and 2016 to 31.3 percent in 2020<sup>33,34</sup>*

*Restoratives most frequently placed by general dental practitioners now in Lagos include:*

- 1. High viscosity glass ionomer restoratives  
Fuji IX - by GC Europe<sup>19</sup>  
Amalomer – by Advanced<sup>29</sup>*
- 2. Dental nanocomposites  
i-dent (Lithuania)<sup>30</sup>  
Prevest denpro ltd (India)<sup>31</sup>*
- 3. Gionomers –Beatifil by Shofu<sup>20</sup>*

*From 2014 to date the following international and local meetings and conferences have been held in Nigeria on phase down of dental amalgam;*

- 1. 2014 Abuja, Nigeria- Abuja Declaration on mercury-Africa will be mercury free.  
The Nigerian Dental Association was represented by its then President*
- 2. 2014 CapeTown, South Africa-Alliance for a cavity Free future (ACFF ) 1 Day meeting on new perspectives on caries management (ICDAS-ICCMS) Profs Amid Ismail, Nigel Pitts and other experts, Colgate Palm Olive, Association of Nigerian Dental School Deans (all Deans in Nigeria with Prof RA Adebola the Chairman), Nigerian Dental Association.*
- 3 2016 Lagos, Nigeria –World Alliance for mercury Free Dentistry and the Nigerian Dental Association -1 day meeting on phase down of dental amalgam.*
- 4. 2016 –Lagos, Nigeria-Faculty of Dental Sciences Annual Scientific Conference –Phase down of Dental Amalgam-the Alternatives in Partnership with Federal Ministry of Education and Environment and World Alliance for Mercury Free Dentistry and the Nigerian Dental Association*
- 5. 2019-Abuja Nigeria –Dentist’s Committee for a Mercury Free Africa, World Alliance for Mercury Free World, Association of Nigerian Dental School Deans and Nigerian Dental Association  
Twin event:
  - a. Mercury Free Dentistry Curriculum Update*
  - b. Minamata Convention and Mercury Free Dentistry in General Dental Practice  
International speaker: Prof Joe E Frenken  
International Facilitator : GC Corporation Europe Dr Faycal Iratni (GCC Education Europe).**

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***Recommendations:***

***Faculties of Dentistry in Africa and developing economies should be the focus of dental amalgam phase-down activities:***

- i. They should update their curricula to integrate the principles of 21<sup>st</sup> century dentistry (MID) and promote mercury-free dentistry through conferences, seminars and workshops;***
- ii. They should also be supported to run regular continuing professional development courses for general dental practitioners ;***
- iii. They should be fully integrated into all national phase-down activities and committees; and***
- iv. Their simulation laboratories, the engine room of dental training should be upgraded with E- learning technology.***

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### ***Environmental advantages of non-mercury alternatives.***

*High viscosity glass ionomer restoratives are biocompatible, pulp and tissue friendly restoratives with no reported adverse effects on the environment.<sup>35</sup> This is in contrast to the well documented adverse environmental and human toxicity of dental amalgam.<sup>16</sup>*

*Dental amalgam is a known environmental pollutant with documented soil and underground water pollution and indirect adverse effect on human health. The use of dental amalgam also exposes patients and dental staff to mercury vapor inhalation.<sup>16</sup>*

*In the absence of systems and technologies for sorting, collection, transport and treatment of mercury wastes generated from dental clinics in developing countries, a prolonged phase down of dental amalgam cannot be justified.<sup>36</sup> A 'leapfrogging' phase down strategy with direct transition to mercury free dentistry will safeguard human health and the environment.<sup>22</sup> This is of particular importance as the WHO recently reported that environmental pollution is responsible for 35% of the burden of human diseases in Sub-Saharan Africa compared to 25% worldwide.<sup>37</sup>*

*Developing economies also lack the technology for treating mercury wastes (mercury treatment/stabilization plants).<sup>36</sup> Amalgam separators have also been reported not to be 100% effective as they only separate solid mercury wastes and cannot handle mercury vapor. Therefore there will be continuous emission of mercury vapor from dental clinics.<sup>38</sup>*

*However, amalgam separators can be installed in selected specialist/teaching hospitals where repair and replacement of old and defective amalgam fillings can be installed as part of the safe mercury Amalgam Removal Technique (SMART).<sup>39</sup> This will facilitate the training of future dentists and private practitioners in safe amalgam removal techniques as recommended by the international association of Toxicology and oral medicine. This is without prejudice to the establishment of systems and technologies for monitoring and evaluation of all technologies and materials used in clinical environments in the future.<sup>22</sup>*

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### ***Health advantages of mercury free alternatives/21<sup>st</sup> century dentistry/MID***

*“Mercury is a chemical of global concern owing to its long-range atmospheric transport, its persistence in the environment once anthropogenically introduced, its ability to bio-accumulate in ecosystems and its significant negative effects on human health and the environment”.....first preamble of the Minamata Convention on Mercury @ UNEP <sup>40</sup>*

High viscosity glass ionomer restoratives are biocompatible restoratives that binds chemically to tooth tissues. Furthermore, they are pulp friendly. However, regular monitoring and evaluation of all restorative materials should be instituted. The potential for toxicity with Bisphenol in composite restoratives is well documented in the scientific literature. Manufacturers are now making bisphenol free composites (e.g. Activa Bioactive by Pulpdent Corporation, USA).<sup>17</sup>

Mercury free dentistry (21<sup>st</sup> century/ minimum intervention dentistry) enhances infection control.

Covid 19 is a highly contagious viral infection caused by severe acute respiratory distress coronavirus 2. It was first reported in Wuhan China in December 2019. The principal routes of transmission include close personal contact, touching contaminated materials and surfaces, fecal contamination and coughing, sneezing and speaking.<sup>41</sup> Health care personnel including dentists have being infected by the virus prompting closure of dental clinics in several countries worldwide.<sup>42</sup>

Dentists, dental nurses, dental surgery assistants and dental therapists usually operate in close proximity to both oral and nasal cavities. Traditional 19<sup>th</sup> and 20<sup>th</sup> century ‘drill and fill’ dentistry is heavily dependent on high speed instrumentation with potential for droplet and aerosol generation in the dental environment. There is therefore a high risk of SARS Cov. 2 transmission in the dental environment.<sup>42</sup>

Implementing the principles of minimum intervention dentistry (21<sup>st</sup> century dentistry) in dental practice including the integration of the principles of atraumatic restorative treatment (ART) will reduce aerosol and spatter generation in dental practice and reduce the exposure of dental personnel and patients to cross infection by this highly contagious virus.

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## *Make Mercury History Worldwide*



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