FDI World Dental Federation

Leading the World to Optimal Oral Health

Understanding the Minamata Convention and its effect upon oral health care

Practical advice for dentists

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Preface

The recently adopted United Nations Environmental Programme Treaty on Mercury, known as the Minamata Convention, aimed to protect human health and the environment from the adverse effects of mercury. The FDI World Dental Federation, collaborating with the World Health Organization (WHO) and the International Association for Dental Research (IADR), played a crucial role during the negotiations to balance the need to protect the environment with the provision of optimal oral healthcare. The Treaty goes beyond a simple recommendation to phase down the use of dental amalgam and includes a range of forward-thinking provisions for oral health. These provisions include improved oral health promotion and disease prevention, supporting dental materials research, and offering guidelines for best management practices for amalgam waste. The FDI, in leading the world to optimal oral health, presents this practical informational toolkit to support clinical dentists worldwide so they can understand and comply with the provisions of the Minamata Convention.

The toolkit includes a range of ways that individual dentists can adopt immediately that will allow the best care of patients and at the same time to recognize that dentists have a responsibility to the environment for a healthy future for all humans around the globe.

The Minamata Convention was agreed upon by 147 nations in January, 2013, opened for signatures in October 10, 2013 and has 102 nation signatures as of September 2014. A complete copy of the United Nations Environmental Programme (UNEP) Treaty on Mercury, known as the Minamata Convention and a range of supporting information is available from www.mercuryconvention.org

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Background

Dental caries, despite being largely preventable, is the most common global chronic disease, and is still the most common chronic disease of childhood (Peterson, 2009). Dental amalgam has long been a safe, effective, durable, and affordable material to restore carious teeth. The presence of mercury in dental amalgam led to dentistry and the FDI becoming directly involved with the United Nations Environmental Programme negotiations on mercury. The FDI negotiating team, collaborating with WHO and IADR, worked hard to ensure that health and oral health care would be supported in the treaty whilst still recognizing the need to protect the environment. Specifically, the Minamata convention "upholds the use of dental amalgam as a durable, safe, effective cavity filling material" and calls for phasing down amalgam by supporting prevention and health promotion (thereby requiring fewer restorations), encouraging best management practices for amalgam waste disposal and supporting research into alternative materials. Of unique note, this is the first international treaty to name and include dentistry, prevention and dental research.

Mercury levels in the environment have increased over the last century largely due to human activity. Mercury can be concentrated in the food chain particularly in fish and marine mammals. The town of Minamata, Japan, after which the Treaty is named, experienced severe mercury poisoning disease from industrial release of methylmercury in 1950s.

Products, processes and industries where mercury is used, released or emitted are addressed in the Treaty, and dental amalgam represents a relatively small but quantifiable part of the overall mercury burden. Natural emissions of mercury into the environment, such as volcanoes, have always been present, but human activity has exceeded natural emissions over the last 200 years (Bayne, et al., 2013). Once released, mercury persists in the environment, and can be repeatedly mobilized, deposited and remobilized between air, water, and soil. Although the total use and release of mercury has declined significantly in many countries in recent years, the fact that mercury can be transported by wind and ocean currents means that it can only be controlled effectively at a global level.

Environmental mercury exists in several forms, and those forms have differing impacts on humans and the environment. Methylmercury, which affected the residents of Minamata, is the most toxic form of mercury. Dental amalgam contains mercury that is metallically bound to silver and other trace metals. The extremely minimal release of mercury in various oxidation states from amalgam fillings is considered to be far below the limits set by WHO or other competent authorities (Bayne, et al., 2013). Additionally, dental amalgam waste is a very small contribution to the mercury in the environment, while significant environmental emissions of mercury occur primarily from burning coal chlor-alkali production, artisanal gold mining and fluorescent light bulbs.

By properly handling amalgam and amalgam waste, the dental profession can protect the health of the environment and still provide optimal patient care. Perhaps most importantly, efforts and success in disease prevention will diminish the need for restoration, and therefore diminish the waste products of any restorative material, while increasing human health through improved oral health. Indeed, our leading role in compliance by the dental community with the Minamata Convention will help lead to positive changes to global oral health.

The commitment to a phase-down in the use of dental amalgam in the Minamata convention is supported by nine provisions. To be compliant with the Treaty, governments must adopt at least two of these provisions. The Treaty was designed to allow significant flexibility to account for local circumstances. This means that each country can comply with the Treaty in a unique way and compliance is likely to come into effect by 2017. Dentists should communicate with their local health ministry for the exact details of their country's compliance agreements.

The Minamata Treaty contains the following provisions to support a phase-down in the use of amalgam:

(i) Set objectives to prevent caries thus minimizing the need for restorations;
(ii) Setting objectives aiming at minimizing use of amalgam;
(iii) Promoting the use of alternatives;
(iv) Promoting research into alternative restorative materials;
(v) Promoting training in the use of mercury-free alternatives;
(vi) Discouraging insurance policies that favor the use of amalgam;
(vii) Encouraging insurance policies favor the use of alternatives to amalgam;
(viii) Restricting the use of dental amalgam to its encapsulated form;
(ix) Promoting the best environmental practices to reduce the release of mercury.

Compliance programs will need to be taken up by National Dental Associations, and we encourage all practicing dentists to become involved with their dental associations to assist in advocacy for oral health for all. In many cases countries may already comply with a number of these provisions but the Treaty provides an opportunity to develop and refine the relevant activities. The improvement and extension of initiatives to prevent caries is a clear example of how the provisions provide a framework for improvement rather than a single clear defined end point.

This toolkit is aimed at the clinical dentist and emphasizes the implementation of programs in health promotion and disease prevention, how dental amalgam compares to other direct restorative materials and best management practices for amalgam waste. This Toolkit focuses on the best available practices but recognizes that not all resources are available in all regions of the world. Where appropriate the toolkit indicates possible alternative approaches.

Health Promotion and Disease Prevention

The Minamata Convention was created with the central aim of reducing mercury emissions. Reducing the need for dental restorations will reduce the use of dental amalgam and lead to better oral health with significant improvements in well-being for the global population. Dental caries creates a burden far beyond the simple loss of tooth structure. Treating decay takes children out of school, keeps adults off work and involves treatment costs that far exceed those needed for prevention.

Good oral health directly improves the quality of life and supports better nutrition. There is good evidence that improved oral health is positively correlated with general health. Dentist have an important role is helping their own communities and patients realize that adopting a healthier lifestyle can lead to life-long better health. Many other chronic, non-communicable diseases share risk factors with oral diseases, and improving oral health is likely to have wider benefits.

Rates and incidence of dental caries vary significantly across the globe. Key determining factors include; water fluoridation, the availability of fluoride toothpaste, living conditions, sugar consumption, overall dietary patterns, cultural beliefs, and access to oral healthcare. (Bayne, et al., 2013).

Oral health education for the public must be tailored to the individual country or region. Individual dentists have a role to play in leading and participating in programs aimed to increase oral health literacy in their communities. Many patients do not have the opportunity for optimal conditions for their oral health – socially, politically, economically, or geographically. Even within a single country rates of caries can differ between regions or section of the populations demonstrating that knowledge of oral health and access to appropriate care can vary significantly. Recent global trends in caries have generally shown a decline in many developed countries at the same time as a dramatic increase in some developing countries. This largely reflects changes in dietary patterns including increased and more frequent consumption of sugar (Peterson, 2003). Inequality in oral health around the globe is a complex and significant concern. The IADR has recently adopted research priorities that address the key challenges of gaps in knowledge, insufficient focus on social policy, separation of oral health from general health, and inadequate evidence based data. (Sgan-Cohen, et al, 2013).

Dentists can provide information in healthy practices and decision making in settings that range from schools, health centers or wider community activities. Examples of FDI programs include the Live Learn Laugh partnership with Unilever, which encourages twice daily brushing with fluoride toothpaste. Currently, 40 diverse programs in 37 countries have reached at least one million people with programs to prevent caries.

The progressive nature of caries means that prevention is an integral part of the restorative process. The integrated nature of caries prevention and treatment is encompassed in the field of Minimal Intervention Dentistry. This approach involves prevention, early detection, and early intervention as key components to the rapidly progressing field of. For a comprehensive review of this topic see the following article: Frencken et al., (2012) Int Dent J 62; 223-243.

Personalized Prevention for Dental Patients in the Clinical Setting

The dentist-patient relationship in general dentistry has the unique advantage of supporting lifelong habits and wise choices for health. Creating successful prevention programs in practice can create loyal patients and rewarding relationships for all members of the dental team. An effective clinical program for optimal oral health should include patient education, oral hygiene instruction and motivation, dietary counseling, use of fluoride, early detection, re-mineralization and minimally invasive techniques. The good news is that dentists often have the luxury of seeing patients many times over the course of their lifetimes, and can address and improve upon oral health choices and behaviors. This means that they are well-placed to take account of the risk unique to an individual patient including age, systemic disease, cultural behaviors, family support and financial limitations.

Some prevention plans have been limited by the lack of reimbursement by insurance companies for preventive services. Many countries have, with variable degrees of success established systems to reimburse for restorative services and preventive treatments. In other cases programs for prevention have been only partly funded or totally unfunded. It is to be hoped that the potential for prevention to be key to health promotion and disease, reduction will be recognized by third party payers in the near future. The Minamata Treaty serves to clearly articulate the place for disease prevention within any oral health strategy.

Motivation and active participation by patients in their health choices should involve both the dentist and appropriate members of the dental team. Specific time in every patient appointment can be set aside to discuss and offer support to patients with their participation in their health, and in many practices, a dental professional can be identified to lead a prevention program. To be most effective prevention programs should be customized for the individual allowing decisions to be shared between the patient and dentist. In this way the patient can be most fully involved in process. Although the Minamata Convention is primarily concerned with caries restoration and prevention any preventative programs should not neglect the prevention of oral disease in general, including caries, trauma, periodontal disease and oral cancer.

An individualized prevention program begins with a proper diagnosis, including assessment of risk for caries. The following items in the exam are critical for making appropriate, customized recommendations for patients.

An initial examination should involve:

- Health history – systemic diseases, medications, dry mouth
- Family history of caries, tooth loss, periodontal disease and family routines for oral hygiene, use of fluoride toothpaste
- Dietary patterns – inquiry of frequency of sugars, alcohol consumption, tobacco use

- Plaque levels, periodontal charting, level of bleeding, hygiene habit assessment, fluoride access and use
- Existing decay, decalcification, demineralization in enamel and dentin, and number of previous restorations

Following the full examination the current oral health risk for the patient should be assessed, including urgency of need for treatment. Because the Minamata Convention primarily is concerned with restorations, this toolkit will concentrate on caries management, but it should always be noted that risks for periodontal disease and oral cancer remain key aspects of oral health. These topics will be the subject of future FDI publications.

Important – it is not only what is being asked of patients, but also HOW it is being asked. Being empathetic, non-judgmental, supportive and consultative are critical factors in the successful patient acceptance. The consultative model for patient communications can be adopted by all members of the oral healthcare team. This simple model involves the oral health care provider treating the patient as an equal, but with an understanding that the provider knows more about oral health issues, and is willing to share their knowledge with the patient. Then the patient can choose the optimal course for their health and future with the help of the recommendations from the health care provider. Treatment planning can and should always include a plan to prevent future disease. Almost all the efforts of the dentist can be undone and the best restorations fail if the patient does not maintain good oral hygiene and generally healthy habits.

A treatment plan should be accompanied with patient education regarding prevention and health maintenance, and this should include patient-focused explanations of:

- The continuum of caries – how the disease may be present on many tooth surfaces, even without the presence of "cavities"
- That providing a restoration does not reduce the risk for further decay!
- The causes of caries, and the individual risks for each patient, and for each tooth
- The relationship between simple carbohydrates and caries and the frequency of intake
- And for parents of children – explanation of the role of transmission of caries from primary caregiver to child, as well as providing the example for healthy habits
- The proper use of fluoride toothpaste – twice daily with proper brushing techniques
- Professionally applied fluoride
- Tell-show-do techniques for oral hygiene instructions
- The importance of routine visits to early detection and ongoing prevention
- Catching caries early saves tooth structure, and is a critical part of a minimal intervention approach

Once the understanding of the disease progression of caries is understood and shared with patients, then the proper preventative and restorative treatment options can be presented based upon the individual risk assessment. The patient's future oral health is dependent upon their participation in these choices and accountabilities, and their understanding of their roles in maintenance and prevention.

Individual risk for decay includes, but are not limited to, the following factors (ADA Council on Scientific Affairs, 2006):

- High titers of cariogenic bacteria
- Poor oral hygiene
- Prolonged bottle feeding
- Poor family dental health
- Developmental or acquired enamel defects
- Genetic abnormality of teeth
- Many multi-surface restorations
- Chemo/radiation therapy
- Eating disorders
- Drug/alcohol abuse
- Irregular dental care
- Cariogenic diet
- Active orthodontic treatment
- Presence of exposed root surfaces
- Restoration overhangs and open margins
- Physical or mental disability with inability or unavailability of perform proper oral health care

Twice-daily brushing with fluoride toothpaste is a key part of oral health maintenance and caries prevention. Professionally applied fluoride is also recommended as part of a preventative strategy for patients of all ages that have moderate to high risk of decay. Moderate risk is defined as having one or more of the risk factors listed above (ADA Council on Scientific Affairs, 2006). Typically fluoride varnish should be re-applied every six months but where high risk of caries is identified the clinician should consider reducing the treatment interval to 3 months. Topical fluoride are generally most effectively applied as a varnish, but a 4 minute application of gel forms of fluoride can also be beneficial. Fluoride gels often do not reach the area under the contact point, which is a high caries risk area. The caries risk should be reevaluated and appropriate changes made to the fluoride treatment recommendations at each visit.

An additional preventive treatment that is highly recommended is the use of pit and fissure sealants. Their use should be considered for permanent teeth in children and adolescents before decay is seen but where the tooth or the individual is at increased risk. Sealants may also be used effectively to limit the progression of caries in early non-cavitated lesions (ADA Council on Scientific Affairs, 2008).

Effectively planned preventative treatment will reduce but not eliminate the need for restorations. It is inevitable that some restorations will continue to be required to treat caries and dental trauma. In addition, winning patient acceptance that they have a role to maintain their oral health means that existing restorations are likely to last longer and lead to more long-lasting oral health.

Restorative Dental Materials – comparisons of the options for today, and considerations for the future

Some dental restorations will always be required and it must be recognized that no restorative material is entirely free of risk. The dentist must evaluate the range of options for the patients. This means that dentist need to consider the chemical, biological, and environmental effects of any restorative material. New material will bring its specific challenges and opportunities. Amalgam still represents a long-lasting and effective restorative material and no alternative has yet matched its longevity and ease of use in all clinical situations. The inclusion of dental research in the Minamata treaty recognizes the unmet need for a cost-effective alternative to amalgam that has the same clinical performance. The Minamata Treaty provides a unique opportunity to drive innovation in restorative materials.

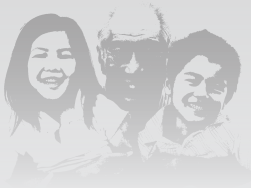
As this paper primarily focuses on the practical needs of the practicing dentist, the complexities of dental materials research are beyond its scope. It is important to recognize the complexity of developing any new restorative material will involve facing a range of barriers. Regulatory approval, intellectual property rights, distribution challenges, educational models, and transfer of knowledge and skill to the workforce are some the key steps in the development pathway of any new dental material. The exact pathway will vary according to national regulatory systems which, may cause large demands on dental manufacturers. (Rekow, et al., 2013a). Because of the vast array of new materials and future materials, dental students must be taught how to evaluate a new material along with the training in the techniques for their use.

When possible or feasible, early detection and early treatment of caries is ideal. Minimally invasive dentistry and the use of remineralization-promoting dental materials are excellent clinical choices for preserving tooth structure in restorative techniques. Similarly Atraumatic Restorative Treatment (ART) with high viscosity glass ionomer cements, offers a method that can arrest early carious lesions. A range of fluoride treatments and fluoride-releasing restorative materials exist that can provide effective early treatment options to promote the remineralization of enamel.

The best choice for restorative materials for more developed carious lesions should include a number of factors including durability, resistance to wear and fracture, leakage and recurrent decay, cavity preparation design considerations, esthetics, post-placement sensitivity, length of appointment time, and relative cost.

An important element for material evaluation is the biocompatibility of the material used. This will determine the risk of an allergenic reaction or other adverse systemic reaction and reflects the genetic uniqueness of individuals. Release of mercury from amalgam is highest at placement and removal of amalgam restorations. Thus, there is no justification to remove a clinically sound amalgam except in patients where allergic reactions to amalgam components are diagnosed (SCENIHR, 2014). Alternative materials, such as composite resins, may also have toxicological risks, including organic solvents that can undergo chemical reactions within the tooth cavity and adjacent structures (SCENIHR, 2014). In general, our best knowledge at this time is that present-day materials have minimal to negligible risk when handled properly, but certainly more research is needed with all dental materials.

While there is a current focus on the fate of amalgam waste it is likely that the impact of waste from all dental materials will be evaluated in the future. Amalgam separators significantly reduce mercury released to the wastewater. However, separators are unlikely



to capture nanoparticles from composites. There is still limited information available on the ultimate fate and environmental impact of these particles (Bayne, et al., 2013). Thus the defined adverse effects of dental amalgam need to be set against a poorly defined impact from other commonly used restorative materials including composites, glass ionomers, or resin ionomers.

This toolkit which offers alternatives to amalgam, will concentrate on the comparative qualities of other directly placed material, specifically; composites, glass ionomers, and resin-ionomers. The evaluations conducted by the European Union Scientific Committee on Emerging and Newly-Identified Health Risks (SCENIHR, 2014) concludes that current evidence does not preclude the use of either amalgam or alternative material in dental restorative treatment. Dentists should remember that the success of any restoration will be influenced by many factors including patient behavior.

The final choice of material will depend on the relative importance of the physical, chemical, and mechanical properties in that specific clinical context. Although many factors will determine the long-term effectiveness of a restoration the clinician has a key role in correct placement of the restoration (Rekow, et al., 2013b; Bayne, et al., 2013). In assessing clinical outcomes, the role of the operator is also critical, and the operator is considered to have the most influence on clinical performance. Cost remains an important factor and amalgam remains generally less expensive than composites and are certainly much less expensive than indirect restorations, such as onlays and crowns.

It is also interesting to note that sometimes materials are used in conjunction with one another to maximize the positive properties of each. For example, a glass ionomer that releases fluoride can be placed in the base of a cavity preparation, and a stronger and better bonded composite placed on the occlusal surface.

Dentists will always be in the position to recommend the best options for patients, but sometimes a patient may not wish to follow these recommendations. In this situation a dentist may elect to comply with the patient's choice but must take care to document the situation in the patient's record and obtain the patient's signature that affirms the patient's comprehension of all the options, as well as their choice. The following material options and comparisons are provided to help the clinical dentist in their choices regarding directly placed materials.

Amalgam

- Primary use – all, especially posterior teeth, and is suitable for heavy loading
- Leakage and recurrent decay – moderate
- Overall durability – good to excellent in large load-bearing restorations
- Cavity preparation considerations – can involve removal of sound tooth structure
- Clinical conditions – material is predictable and forgiving including a tolerance to moisture,
- Wear resistance - high
- Resistance to fracture – brittle, subject to chipping at edge, but good bulk strength
- Fluoride release - no
- Esthetics – poor
- Estimated age for replacement – 10 years

Composites

- Primary use – esthetic dental fillings and veneers
- Leakage and recurrent decay – recurrent decay can be prevented by proper tooth bonding
- Overall durability – good in small to moderate size restorations
- Cavity preparation considerations – adhesive bonding permits removal of less tooth structure
- Clinical conditions – requires well controlled, dry field; material is less forgiving
- Wear resistance - moderate
- Resistance to fracture - moderate
- Fluoride release - no
- Esthetics – excellent, but may stain or discolor over time
- Estimated age for replacement – 7 years, however new reviews show longer

Glass ionomers

- Primary use – small, non-load bearing fillings, cavity liners
- Leakage and recurrent decay – similar to other materials, fluoride release may be beneficial
- Overall durability – poor in load bearing restorations, moderate in non-load bearing
- Cavity preparation considerations - adhesive bonding permits removal of less tooth structure,
- Clinical conditions - requires well controlled field; material is less forgiving
- Wear resistance - poor on occlusal surfaces
- Resistance to fracture – low resistance
- Fluoride release - yes
- Esthetics – color is good, but newer compositions have improved esthetic properties
- Estimated age for replacement – 4 years, some recent reviews state longer timeframes

Resin ionomers

- Primary use – small non-load bearing fillings, cavity liners
- Leakage and recurrent decay - similar to other materials, when properly bonded fluoride release may provide benefit to patients at high risk of decay,
- Overall durability - poor in load bearing restorations, moderate to good in non-load bearing
- Cavity preparation considerations - adhesive bonding permits removal of less tooth structure
- Clinical conditions - requires well controlled field; material is less forgiving
- Wear resistance – poor on occlusal surfaces
- Resistance to fracture – low to moderate resistance
- Fluoride release - yes
- Esthetics - color is good, but material is more opaque than tooth structure
- Estimated age for replacement – 2 years

For further guidance and information see the ADA 2003 and Petersen, 2009.

As dental research is also a key component to the Minamata Convention, we can look forward to the future with ongoing improvements and innovations in materials.Atraumatic Restorative Technique is a significant innovation for treatment of caries in a variety of clinical settings, including those that have minimal electrical and suction capabilities, and certainly complies with the intentions of the Minamata Convention (Frencken et al., 1996).

Best Management Practices for Amalgam Waste and Dental Mercury Hygiene

Given that amalgam may sometimes be the best choice, or the only option, for effectively restoring carious teeth, the FDI fully supports the proper handling of dental amalgam, its waste, and the mercury waste associated with historic outdated uses of mercury in dentistry. The following section provides dentists with clear guidelines so they can protect the environment and ensure the safety of dental workers and patients. `

The provisions of the Minamata Convention include a requirement that only pre-encapsulated amalgam must be used. The management of dental amalgam waste is the responsibility of the health care facility/dental surgery, and individual dentists. Where dental amalgam or mercury transport or recycling is unavailable, precautions must be taken in handling and storing the existing amalgam waste or mercury. These include containment of waste amalgam in gas and liquid tight containers to prevent release into the environment. Waste containing mercury should be kept separate from other clinical and non-clinical waste. In all cases amalgam or mercury should not be discharged or released in to wastewater.

Current practices for handling amalgam waste vary significantly throughout the globe. Amalgam separators and recycling of amalgam waste has been effectively implemented in many regions. Currently, amalgam separators are evaluated according to international standards set by ISO 11143. Amalgam waste standards are required in some countries, electively supported by dentists in other countries, and do not exist at all in other countries. The use of such systems is becoming steadily more widespread and is viewed by the FDI as best practice. It is likely that future assessment of dental waste will not be confined to amalgam waste but will include the complete range of dental materials and we will address this in due course. Dentists can and should always aim to apply best available management practices according to their local circumstances.

Recommendations for Best Management Practices (BMP) for amalgam waste have been available to the dental community for several years. The World Health Organization put forward specific BMPs in its document, "Future Use of Materials for Dental Restoration" in 2009. Other national dental associations have also developed clear guidelines for the handling of dental amalgam waste. As an example, the BMP recommendations of the American Dental Association are included in full as an Appendix to this document.

Separating amalgam waste from other waste, and proper storage of the waste are the primary in-office procedures for amalgam waste. Chair-side traps collect larger portions of amalgam in the vacuum system, vacuum pump filters collect smaller particles, and selecting and installing an amalgam separator that complies with ISO standard 11143 can reduce emissions of amalgam to wastewater. The entire dental team must be trained in both the rationale and techniques of handling waste.

The following Dental Mercury Hygiene Recommendations are adapted from the American Dental Association Council on Scientific Affairs. (source: ADA Council on Scientific Affairs (2003) JADA, Vol. 134; 1498-99):

- Use only precapsulated amalgam alloys. If you have bulk elemental mercury in the office, it should be recycled at an appropriate facility. If a recycling facility is unavailable, the mercury must be stored in an air and water tight container.
- Use an amalgamator with a completely enclosed arm.
- Recap single-use capsules after use, store them in a closed container and recycle them. Do not put used capsules in biohazard containers, contaminated waste containers or regular garbage. If recycling is unavailable, the capsules must be contained and stored in an air and water tight container until recycling becomes available.
- Salvage amalgam pieces from restorations after removal and recycle the amalgam waste.
- Use chairside traps, vacuum pump filters, and amalgam separators to retain amalgam and recycle their contents. Never rinse devices containing amalgam over drains or sinks.
- Recycle teeth that contain amalgam restorations. Don't dispose of extracted teeth that contain amalgam restorations in biohazard containers, infectious waste containers, sharps containers or regular garbage. If recycling is unavailable, store these teeth in the air and water tight containers in which the other amalgam waste is stored.
- Use dental water line cleaners that minimize the dissolution of amalgam. Avoid using bleach or chorine-containing cleaners to flush wastewater lines.
- Use care when handling amalgam. Avoid skin contact with mercury or freshly mixed amalgam.
- Use high-volume evacuation systems (fitted with traps or filters) when finishing or removing amalgam.

Management of Mercury Spills

- Never use a vacuum cleaner of any type to clean up the mercury.
- Never use household cleaning products to clean up the spill, particularly those containing ammonia or chlorine.
- Never pour mercury, or allow it to go, down the drain.
- Never allow people whose shoes may be contaminate with mercury to walk around or leave the spill area until the mercury-contaminated items have been removed.
- Do carefully collect the spilled mercury and store in a gas and liquid tight container.

References

American Dental Association Council on Scientific Affairs (2003). Dental Mercury Hygiene Recommendations JADA, Vol. 134; 1498-99.

American Dental Association Council on Scientific Affairs (2006). Professionally applied topical fluoride: evidence based clinical recommendations. JADA 137; 1151-59.

American Dental Association Council on Scientific Affairs (2008). Use of pit and fissure sealants: Evidence-based clinical recommendations. JADA 139; 257-68.

Bayne, S., Petersen, P.E., Piper, D., Schmalz, G. and Meyer, D. (2013). The Challenge for Innovation in Direct Restorative Materials. AdvDent Res 25; 8-17.

Frencken, J., Pilot, T., Sonpaisan, Y. and Phantumvanit, P. (1996) Atraumatic Restorative Treatment (ART): Rational, Technique and Development. Journal of Public Health Dentistry 56; 135-140.

Petersen, P.E. (2003). The World Oral Health Report 2003: Continuous improvement of oral health in the 21st century – the approach of the WHO Global Oral Health Programme. Community Dent Oral Epidemiol 31(Suppl 1):3-24.

Petersen P.E. (2009). Future use of materials for dental restorations Geneva: World Health Organization.

Rekow, E.D., Fox, C.H., Watson, T., Petersen, P.E. (2013a) Future Innovation and Research in Dental Restorative Materials. Adv Dent Res 25; 2-7.

Rekow, E.D., Bayne, S.C., Carvalho, R.M. and Steele, J.G. (2013b) What Constitutes an Ideal Dental Restorative Material? Adv Dent Res 25; 18-23.

Sgan-Cohen H.D., Evans R.W., Whelton H., Villena R.S., MacDougall M., Williams D. M., and IADR_GOHIRA Steering and Task Groups (2013). IADR Global Oral Health Inequalities Research Agenda (IADR-GOHIRA): A Call to Action. J Dent Res 92(3) 209-211.

Scientific Committee on Emerging and Newly Identified Health Risks SCENHIR 2014: Preliminary opinion on the safety of dental amalgam and alternative dental restoration materials for patients and users. European Commission Scientific Committee.

Appendix

BEST MANAGEMENT PRACTICES FOR AMALGAM WASTE

Dental Amalgam Waste

Dental amalgam waste can be recycled to help prevent the release of mercury to the environment. Following the simple suggestions outlined in this document will help protect the environment.

Background

Concern about the effects of mercury in the environment has increased over the years. Mercury in the environment is bio-accumulative, which means that it can build up in fish and cause health problems in humans and other animals that eat fish. Many state health professionals recommend limiting fish consumption, especially for children and pregnant women.

Mercury is a naturally occurring metal; however, about half of the mercury released to the environment comes from human activity. Of that amount, 53% is emitted from combustion of fuels for energy production and 34% is from the combustion of waste.[1] Sources associated with manufacturers and consumers make up the remaining 13%, with dentistry contributing less than one percent.

Some mercury released into the air eventually collects in the waterways, where it enters the food chain. As a precautionary measure, U.S. regulators typically assume that all or most of the mercury released into the air or surface water may accumulate in fish. According to the EPA in 2000, metals (mainly due to the detection of mercury in fish tissue samples) were the second most common pollutant impairing 3.2 million acres of the 17.3 million acres of assessed lakes (the assessed lakes comprised 43% of the total lake acres).[2]

Although mercury in the form of dental amalgam is stable, amalgam should not be disposed of in the garbage, infectious waste "red bag," or sharps container. Amalgam also should not be rinsed down the drain. These cautions are important because some communities incinerate municipal garbage, medical waste, and sludge from wastewater treatment plants. If amalgam waste ends up in one of these incinerated waste streams, the mercury can be released to the environment due to the high temperatures used in the incineration process. Increasingly, local communities are enacting restrictions on the incineration of wastes containing mercury.

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[1] Office of Air Quality Planning and Standards, Office of Research and Development. Mercury Study Report to Congress. Volume II: An inventory of anthropogenic mercury emissions in the United States. Washington, D.C.: Environmental Protection Agency. Publication No. EPA-452/R-97-004. December 1997, p. ES-6.

[2] EPA. Quality of America's Lakes. http://www.epa.gov/owow/lakes/quality.html (accessed April 2007).

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The good news is that amalgam waste, kept separate from other waste, can be safely recycled. The mercury can be recovered from amalgam wastes through a distillation process and reused in new products. The ADA strongly recommends recycling as a best management practice for dental offices.

The following information demonstrates how to manage and recycle dental malgam waste to help protect the environment.

Glossary of Amalgam Waste Terms

- Amalgam capture device is an apparatus such as a chair side trap, vacuum pump filter or amalgam separator that collects amalgam particles.
- Amalgam sludge is a mixture of liquid and solid material that collects within vacuum pump filters, amalgam separators or other amalgam capture devices that may be used.
- Contact amalgam is amalgam that has been in contact with the patient. Examples are extracted teeth with amalgam restorations, carving scrap collected at chair side, and amalgam captured by chair side traps, filters, or screens.
- Dental Best Management Practices are a series of amalgam waste handling and disposal practices that include, but are not limited to, initiating bulk mercury collection programs, using chair side traps, amalgam separators compliant with ISO 111433 and vacuum collection, inspecting and cleaning traps, and recycling or using a commercial waste disposal service to dispose of the amalgam collected.
- Empty amalgam capsules are the individually dosed containers left over after mixing precapsulated dental amalgam.
- Non-contact amalgam (scrap) is excess mix leftover at the end of a dental procedure.

The ADA recommends against the use of bulk elemental mercury, also referred to as liquid or raw mercury, for use in the dental office. Since 1984, the ADA has recommended use of precapsulated amalgam alloy. If you still have bulk elemental mercury in the office, you should recycle it. Check with a licensed recycler to determine whether they will accept bulk mercury. Do not pour bulk elemental mercury waste in the garbage, red bag or down the drain. You also should check with your state regulatory agency and municipality to find out if a bulk mercury collection program is available. Such bulk mercury collection programs provide an easy way to dispose of bulk mercury.

Steps for Recycling Amalgam Waste

1. Stock amalgam capsules in a variety of sizes to minimize the amount of amalgam waste generated.
2. Amalgam waste may be mixed with body fluids, such as saliva, or other potentially infectious material, so use personal protective equipment such as utility gloves, masks, and protective eyewear when handling it.
3. Contact an amalgam waste recycler about any special requirements that may exist in your area for collecting, storing and transporting amalgam waste.
4. If you need to find a recycler, check with your city, county or local waste authority to see whether they have an amalgam waste recycling program.
5. Store amalgam waste in a covered plastic container labeled "Amalgam for Recycling" or as directed by your recycler. Your recycler may have its own requirements, so ask your recycler about containers and what may be placed in them.
6. Look for recyclers who comply with the ADA-ANSI standard. This standard is meant to encourage recycling.

[3] International Standards Organization 11143:1999. Dental Equipment – Amalgam Separators.

Questions to Ask Your Amalgam Waste Recycler

Below is a list of questions you may want to ask your amalgam waste recycler. Note that not all recycling companies accept every type of amalgam waste, and the services offered by recyclers vary widely. The ADA recommends that you contact a recycler before recovering amalgam and ask about any specific handling instructions the recycler may have. Importantly, select a reputable company that complies with applicable federal and state law and provides adequate indemnification for its acts and omissions. Look for recyclers who comply with ANSI/ADA Specification 109: Procedures for Storing Dental Amalgam Waste and Requirements for Amalgam Waste Storage/Shipment Containers.[3] This standard is meant to encourage recycling.

Ask Your Recycler ...

- What kind of amalgam waste do you accept?
- Do your services include pick up of amalgam waste from dental offices? If not, can amalgam waste be shipped to you?
- Do you provide packaging for storage, pick up or shipping of amalgam waste?
- If packaging is not provided, how should the waste be packaged?
- What types of waste can be packaged together?
- Do you accept whole filters from the vacuum pump for recycling?
- Is disinfection required for amalgam waste?
- How much do your services cost?
- Do you pay for clean non-contact amalgam (scrap)?
- Do you accept extracted teeth with amalgam restorations?
- Does your company have an EPA or applicable state license?
- Does the company use the proper forms required by the EPA and state agencies?
- Do your procedures comply with ANSI/ADA Specification 109: Procedures for Storing Dental Amalgam Waste and Requirements for Amalgam Waste Storage/Shipment Containers?[4]

[4] American Dental Association Council on Scientific Affairs. American National Standard/American Dental Association Specification No. 109. Procedures for storing dental amalgam waste and requirements for amalgam waste storage/shipment containers, 2006.

Best Management Practices for Amalgam Waste

DO	DON'T
Do use precapsulated alloys and stock a variety of capsule sizes.	*Don't* use bulk mercury
Do recycle used disposable amalgam capsules.	*Don't* put used disposable amalgam capsules in biohazard containers, infectious waste containers (red bags) or regular garbage
Do salvage, store and recycle non-contact amalgam (scrap amalgam)	Don't put non-contact amalgam waste in biohazard containers, infectious waste containers (red bags) or regular garbage
Do salvage (contact) amalgam pieces from restorations after removal and recycle the amalgam waste	*Don't* put contact amalgam waste in biohazard containers, infectious waste containers (red bags) or regular garbage
Do use chair-side traps, vacuum pump filters and amalgam separators to retain amalgam and recycle their contents	*Don't* rinse devices containing amalgam over drains or sinks
Do recycle teeth that contain amalgam restorations. (Note: Ask your recycler whether or not extracted teeth with amalgam restorations require disinfection)	*Don't* dispose of extracted teeth that contain amalgam restorations in biohazard containers, infectious waste containers (red bags), sharps containers or regular garbage
Do manage amalgam waste through recycling as much as possible	*Don't* flush amalgam waste down the drain or toilet
Do use line cleaners that minimize dissolution of amalgam	*Don't* use bleach or chlorine-containing cleaners to flush wastewater lines

Practical Guide to Integrating BMPs Into Your Practice

Non-contact (scrap) amalgam

- Place non-contact, scrap amalgam in wide-mouthed, container that is marked "Non-contact Amalgam Waste for Recycling."
- Make sure the container lid is well sealed.
- When the container is full, send it to a recycler.

Amalgam capsules

- Stock amalgam capsules in a variety of sizes.
- After mixing amalgam, place the empty capsules in a wide-mouthed, airtight container that is marked "Amalgam Capsule Waste for Recycling."
- Capsules that cannot be emptied should likewise be placed in a wide-mouthed, airtight container that is marked "Amalgam Capsule Waste for Recycling."
- Make sure the container lid is well sealed.
- When the container is full, send it to a recycler.

Disposable chair-side traps

- Open the chair-side unit to expose the trap.
- Remove the trap and place it directly into a wide-mouthed, airtight container that is marked "Contact Amalgam Waste for Recycling."
- Make sure the container lid is well sealed.
- When the container is full, send it to a recycler.

- Traps from dental units dedicated strictly to hygiene may be placed in with the regular garbage.

Reusable chair-side traps

- Open the chair-side unit to expose the trap.
- Remove the trap and empty the contents into a wide-mouthed, airtight container that is marked "Contact Amalgam Waste for Recycling."
- Make sure the container lid is well sealed.
- When the container is full, send it to a recycler.
- Replace the trap into the chair-side unit (Do not rinse the trap under running water as this could introduce dental amalgam into the waste stream.

Vacuum pump filters

- Change the filter according to the manufacturer's recommended schedule. Note: The following instructions assume that your recycler will accept whole filters; some recyclers require different handling of this material, so check with your recycler first.
- Remove the filter.
- Put the lid on the filter and place the sealed container in the box in which it was originally shipped. When the box is full, the filters should be recycled.

Amalgam separators

- Select an amalgam separator that complies with ISO 11143.
- Follow the manufacturer's recommendations for maintenance and recycling procedures.

Line cleaners

- Use non-bleach, non-chlorine–containing line cleaners, which will minimize amalgam dissolution, such as those listed in the Additional Resources section of this document.

FDI resources

Dental restorative materials and the Minamata Convention on Mercury - Guidelines for Successful Implementation

http://www.fdiworldental.org/media/54670/minamata-convention_fdi-guidelines-for-successful-implementation.pdf

FDI Policy Statement: Dental Amalgam and the Minamata Convention on Mercury

http://www.fdiworldental.org/media/55201/6-fdi_ps-dental_amalgam_and_minamata_adopted_gab_2014.pdf

Understanding the Minamata Convention and the Impact on Oral Health Care - Practical Advice for Practicing Dentists (Powerpoint presentation)

http://www.fdiworldental.org/media/56506/understanding_the_minamata_convention_and_its_impact_on_oral_health_-_guidelines_for_dentists.pptx

Additional Resources

The following articles published in the Journal of the American Dental Association are available through the ADA Division of Science and also are available to ADA members online.

For information on proper mercury hygiene practices see "Dental Mercury Hygiene Recommendations". 2003:134(11);1498-9.

For information on choosing line cleaners that minimize the dissolution of mercury from amalgam see: "The effect of disinfectants and line cleaners on the release of mercury from amalgam" 2006:137(10);1419-25.

For information on amalgam separators see:

- "Laboratory evaluation of amalgam separators" 2002:133;577-89.
- "Evaluating amalgam separators using an international standard" 2006:137;999-1005.
- "Purchasing, installing and operating dental amalgam separators: Practical issues" 2003 134:1054-65.

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