

Removal of Amalgams: Is it Beneficial?



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Disclaimer: Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

Conflict of Interest Disclosure Statement

- The author reports no conflicts of interest associated with this course.

Introduction - Removal of Amalgams

Removal of Amalgams: Is it Beneficial? is designed to assist dental professionals in answering specific questions a patient may ask about their concerns related to dental amalgam materials. This course will also state some specific recommendations for consideration if the removal of amalgam is warranted and also review the safety considerations for those who work in the dental office such as dentists, dental hygienists, dental assistants and front desk personnel, as well as the patient receiving treatment.

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Overview

Many patients have become concerned that amalgam restorations, which contain mercury, may be leaching from the tooth and causing health issues such as lichen planus and other skin related disease states. Reports of studies and articles have linked amalgam material to multiple sclerosis, cancer, Parkinson's disease and poorer health in individuals. Mercury accumulation in the body is known to come from exposure to the substance through fish consumption and occupational exposure. It has been well-known that physical handling of mercury is toxic and associated with hair loss, tremors, brain disorders-mental instability, loss of teeth and difficulty walking. As patients read current research, they continue to ask if their amalgams should be removed. The dental professional is being called upon to answer these questions and engage in dialogue with the patient. With new regulations on amalgam separators that are mandated to be in place by 2020, more questions have been raised on the environmental aspects of mercury contamination as well.

This continuing education course is designed to assist in answering specific questions that a patient may ask a dental professional about the concerns that they have related to dental amalgam materials. This course will also state some specific recommendations for consideration if the removal of amalgam is warranted and also review the safety considerations for those who work in the dental office such as dentists, dental hygienists, dental assistants and front desk personnel, as well as the patient receiving treatment.

Learning Objectives

Upon completion of this course, the dental professional should be able to:

- List the ramifications and the health hazards of amalgam in both the elemental and methylmercury (CH₃Hg) forms.
- List the physical signs of a possible mercury saturation within the body.
- Discuss the proper techniques in amalgam removal from the mouth.
- Name the countries who have banned the use of amalgam in tooth restorations.
- List the states within the United States mentioned in this course who require that patients be informed about restorative materials and the choices of these materials.
- Discuss the new legislation requiring amalgam separators in 2020.

Introduction

Dental amalgam restorative material has been used for many years dating back to the middle ages-and even before this period, as mentioned by Hyson in *Amalgams: Its History and Perils* (2006).¹ The use of such materials is not new but techniques in the use of these materials has greatly improved overtime in both preparation and placement of all existing restoration materials. Postings on the internet and conversations on this subject have suggested that amalgam restorations, which contain mercury, may be contributing to and linked to oral and systemic problems. Patients who are concerned about the safety issue of amalgams are asking questions of their dental professionals. Additionally, environmental issues are of concern as well since amalgam material has been released into the environment for decades. Notations about general health problems have been especially pervasive over the past twenty years worldwide-not only for patients but for those in fields such as dentistry that involve occupational mercury exposure in the work environment. As patients read these postings and deal with their own health issues, the subject appears to surface more frequently in articles and over the internet. With the development of the internet capabilities and search modalities, it is much easier to find information, share thoughts with others and ask relative questions related to the individuals' own health concerns. This is

especially relevant for Facebook and LinkedIn users where comments and discussion often occur between groups of people.

This course provides current information on the use of amalgam in restorative dentistry, the removal of amalgam from teeth and work-related hazards associated with amalgam. It will also improve communication with the patient and determine the best practices when considering removal of the amalgam material for all those involved. This course is not to suggest that dental amalgam should be removed because of health implications, but rather to assist the clinician in determining whether an amalgam should be removed when requested by a patient.

Dental amalgam is a combination of metal materials such as silver, copper, tin and zinc that is then mixed with mercury. The total composition is 50% elemental mercury (Hg^0) and 50% elemental silver along with traces of other metals added to manipulate the material. Upon mixing with the other metals such as silver, copper, and tin, the elemental mercury is converted into inorganic mercury in the form of intermetallic compounds ($Ag_3Hg_3 + Sn_{1-8}Hg$). Small amounts of Hg^0 are released from amalgam restorations and absorbed through the lungs as Hg^0 vapor.²⁸ Dental amalgam has been a preferred material for restoring teeth due to decay because of its availability, adaptability and durability. Even with the concerns related to mercury, the economical factor and long-lasting quality are often two prime considerations for its use today. Since dental amalgam is considered a stable material and in the form of inorganic Hg^0 , the concerns have not been as great with many organizations or individuals. Methylmercury (CH_3Hg), on the other hand, is found in fish and the wastewater, surface waters and the air. CH_3Hg is readily absorbed within the tissues of the body and is cumulative over time. Mercury toxicity according to the California Dental Association, is determined by the form of mercury, route and duration of exposure and dose.²²

The History of Dental Amalgams

According to timelines from the American Dental Association,^{1,4} long-term events brought the use of dental amalgam into the American

population, but the material has been used in other cultures since very early times. During the middle ages a medical text in China mentions the use of "silver paste," as a type of amalgam. Hyson JM (2006), cited its appearance in the Chinese materia medica of Su Kung back in 659 A.D. during the Tang Dynasty. Hyson points out that in 1528, amalgam was recommended by a physician in Germany as a filling material.¹

In an ADA timeline,⁴ there is mention of the dates 1833-1850 - as the introduction of an amalgam filling material in the United States under the name Royal Mineral Succedaneum. Two brothers, who originated from France, were cast as charlatans whose unscrupulous methods spark the "**amalgam wars**," within the dental profession over the use of amalgam fillings. Mercury, even in early times, has been termed "liquid silver" and some hazards in using/handling the material have been known. Workers in the felt hat industry at one-time dipped furs into a mercury liquid to soften the furs. Inhalation of the vapors produced tremors, loss of teeth, difficulty walking and mental instability.¹

Amalgam and Safety Concerns

The safety question is asked frequently by patients who have obtained information from various sources and are concerned about the long-term health effects of mercury in the environment and particularly in their own bodies. Dental professionals are frequently asked these questions by many patients who want to know if removing amalgams will assist in any systemic or health improvements or may be the cause of conditions such as oral lichen planus, systemic diseases such as multiple sclerosis or their long-term, overall health and well-being. Generally a restoration is replaced because of several factors: marginal defects, fracture of an existing restoration or adjacent tooth surface or unacceptable appearance.³⁰ Replacement of existing restorations accounts for more than half of restorations placed.³⁰ The other side of the equation is whether placing new amalgams will be detrimental to the health of the individual. Should the provider consider a different material and, if yes, what would that be? Studies by Martin et al. 2005,²⁹ found detectable amounts of resin material in the

urine of children who had resin composites as well. There appears to be some debate on the safety of dental restorative materials in general.

Many patients over the age of 40 years old may have one or more amalgam restorations, and in some cases the examiner may find dental amalgams in most posterior teeth. Amalgam was the restoration of choice for many decades in the United States and in other countries as well. However, some European countries have taken a phase-down approach to limit mercury exposure and to limit amalgam as a first-line restorative material. Lynch et al. 2014 & 2018, offers some guidelines based on evidence-based research.⁶⁷ The European level guidance recommends the use of resin materials in posterior teeth, but amalgam may still be used in a large number of cases. This is especially relevant when multiple restorations are needed, because of the monetary considerations and reimbursement qualifications. A major factor cited for amalgam consideration in the paper by Lynch is the National Health Services (funded dental services) that accepts the continued use of amalgam in posterior teeth. Since the option is still available, providers may use the amalgam material because of the lower cost for certain patients where the financial issue is of a major concern.

Some countries have banned or restricted the amalgam restorations such as Norway in 2008 and Sweden (Aaseth J et al. 2018,¹⁰ as well as restrictions on its use in Germany and Denmark. These countries have favored the composite/resin materials for all teeth. Some countries have restrictions on using amalgam in pregnant women, lactating women and children under certain ages-the list includes under 6 years of age and as old as 12. Children are especially susceptible to mercury exposure because of the various stages of development and the central nervous system is a primary target organ of Hgo, as well as the kidney and the brain.²⁸

Some states within the United States of America have legislation requiring that informed consent for dental patients receiving amalgam restorations to be available and addressed by clinicians to inform the patient.

Connecticut, California and Maine require that the literature must be available when questions arise related to amalgam safety, patient choices or concerns are asked of a facility or dental professional. Although states such as Connecticut only require a posting suggesting that the material is available upon request.

"There must be some posting so that the patient knows that this material can be available when requested." The STATE OF CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION Hartford, Connecticut, displays such a document at the website: [/https://www.csda.com/docs/default-source/regulations/amalgam](https://www.csda.com/docs/default-source/regulations/amalgam).

The state of Maine, also requires that patients have access to material similar to those distributed in Connecticut: A posting by The Maine Center for Disease and Control Prevention on November 2013 states a list of questions related to the Maine Dental Practice Act

Title 32 MRSA Ch. 16, Subchapter 3, §1094-C (the Maine Dental Practice Act) requires that any dentist who uses mercury or a mercury amalgam in any dental procedure shall display the poster in the public waiting area of the office and must provide each patient with a copy of the brochure. The link below provides this brochure.

<http://legislature.maine.gov/legis/statutes/32/title32sec18391.html>

A publication in the Journal of Toxicology, 2008, by Edlich, et al. makes the suggestion that patients should be informed about the advantages and disadvantages of dental material products that are being used in their mouth and that brochures with these statements should be provided. An informed decision or selection can then be made by the patient and the dentist. The authors present a case of a patient with multiple sclerosis who was unknowingly exposed to mercury in a root canal with a crown.²⁶

In a study conducted in Pakistan (Khwaja et al. 2016) the authors concluded that in

countries where dental amalgam is still permitted, there should be more education directed toward dental schools in teaching the students adequate training in minimizing mercury exposure.¹⁰ This would include amalgam separators, capsulated mercury and mechanized mixing of the materials. Also included would be the safe removal of restorative materials. Many offices in the United States have stopped using amalgam mainly because there have been improvements in alternative materials, such as resin composites in recent decades. In a study by Eltahlah et al. 2018,¹ the authors state that the USA, Iceland, Finland Sweden and Australia have adopted the use of resin materials in posterior teeth. With this said, many clinicians will tell you that amalgam is a strong material and when properly placed, will last for decades, is economical and poses no health concerns when properly handled. Other studies by Opdam, (2010)³¹ in a 12-year follow up of posterior resin materials and amalgam, support the high success rate of resin materials for posterior teeth. Some offices do still recommend amalgam materials in many cases and many countries will still use them because of regulation criteria and the monetary value of amalgams.

According to the American Dental Association, "Dental amalgam is considered a safe, affordable and durable material that has been used to restore the teeth of more than 100 million Americans. It contains a mixture of metals such as silver, copper and tin, in addition to mercury, which binds these components into a hard, stable and safe substance. Dental amalgam has been studied and reviewed extensively and has established a record of safety and effectiveness."

Disease States and Amalgams

The International Oral Lichen Planus Support Group² receives many emails and letters from patients who constantly search for causes related to their oral lichen planus. Many patients wonder if mercury leakage is causing their disorder or making it worse. And, to add to the confusion, conclusions in pathology reports often indicate a diagnosis of what is termed "a lichenoid-type reaction."³ Lichen

planus usually affects an older population and most patients have multiple amalgam restorations since that has been the choice of restorative materials during their lifetime. We often are asked, "If I have oral lichen planus, should I remove my amalgams because of questionable mercury safety and potential mercury leakage? And, "Do you think this is causing my lichen planus?"

The lasting quality of amalgam is not a debate. However, when amalgam leaks or when the dental material is removed, mercury vapor is released, in the form of elemental Hg⁰, and is absorbed by the lungs and the body (FDA, 2015).²⁸ High levels have effects on the lungs, kidneys, central nervous system and brain. Mercury from dental amalgam (Hg⁰ and other sources (e.g., fish), in the form of CH₃Hg, occur in many individuals and these forms are bio accumulative.

Mercury is also released in extremely small amounts from dental amalgams while normal functions are performed such as chewing, eating, brushing, grinding of teeth and even polishing teeth in the dental office.

In a 2017 published study, Bengtsson & Hylander wrote a paper titled, "Increased mercury emissions from modern dental amalgams" that evaluated the emissions of mercury and vapor emissions in modern high copper amalgams used in Europe and the United States. The authors cite that amalgams are a mixture of mercury and one or more other metal powders referred to as the alloy (silver, tin, copper or zinc). The mixing ratio is approximately 50/50. The mixture of the two components is termed, dental amalgam. Amalgams may be either low or high copper content. The high non-γ2 amalgams introduced in the 1970's emit high amounts of mercury vapors. These newer amalgams with high copper were developed for their mechanical strength and corrosion resistance. The study authors challenged the assumption that mercury in dental amalgam is firmly bonded to the alloy, due to the mercury-rich droplets found on the surface of the newer high copper dental amalgams. When high copper amalgams are stimulated/polished, mercury-rich droplets are visible using a SEM microscope (Figure 1).

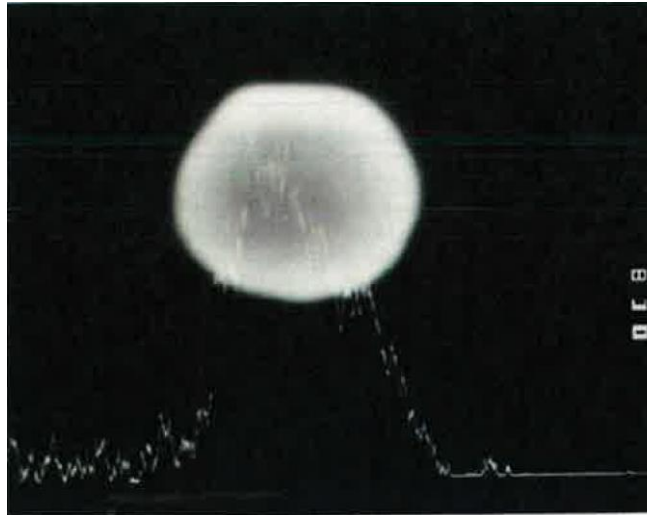


Figure 1. Depicts Release of Metal Mercury Rich Droplets.¹⁹
 A sphere of mercury on the surface of modern high copper non- γ_2 -amalgam, documented with a scanning electron microscope (SEM). Note the strong signal from mercury as the electron beam passes the sphere .
 Courtesy of Dr. Ulf G Bengtsson and Dr. Lars D. Hylander.

In previous studies, the low copper amalgams (prior to the 1970's), also referred to as the (γ_2 -amalgams), were found to emit less mercury than the newer, high copper amalgams (non- γ_2 amalgams). The emitted mercury vapor in high copper amalgams emitted 3-43 times as much mercury vapor than the original lower copper amalgams used before 1970's. Depending upon the type and mixture, the high copper amalgams (non- γ_2 -amalgams) had the highest emission of mercury vapors. The authors conclude that chewing, polishing or temperature changes related to hot foods may stimulate higher emission of mercury vapor and over time, these may amount to more cumulative exposure.

According to the FDA, "Some individuals have an allergy or sensitivity to mercury or the other components of dental amalgam (such as silver, copper, or tin). Dental amalgam might cause these individuals to develop oral lesions or other contact reactions that can affect the skin and the mucous membranes. If a patient is allergic to any of the metals in dental amalgam, this patient would not be a good candidate for amalgam. Other treatment options should be discussed with the patient. Positions from the ADA (2016) state that there is no association

with Alzheimer's Disease, Parkinson's Disease, Lupus, Multiple Sclerosis and other degenerative diseases that have been suggested in past articles.³The statement cites multiple studies from reputable journals and known organizations noting a disconnection to these disease states.

Some patients ask if all amalgams should be replaced and if the mercury leakage that may occur in older restorations is contributing to oral tissue ulcerations such as oral lichen planus. Oral tissue that is in direct contact with an amalgam restoration or perhaps a metal (gold) crown may exhibit what is called a "lichenoid" reaction. A dermatologist can perform what is termed "Patch Testing" and other tests to determine if there is evidence of metal sensitivity. Reports of amalgam removal that is linked to tissue reaction has been known for many years. Sometimes the tissue contacting the metals will improve upon removal of the amalgam or gold crown and the clinician may conclude that there was product sensitivity when improvement results after removal. Recent studies by Tiwari, et al. 2018¹⁴ cited a high rate of clinical improvement (95%) of patients' reduction of lichen planus upon the removal of existing dental restorations. Bjorkman et al., 2017¹¹

reported an improvement in overall health complaints in a group of patients five years after removal of amalgam restorations. The patch tests indicated allergy sensitivity to gold, mercury, nickel, copper, potassium dichromate and methylhydroquinone. Even when biopsied and viewed under a microscope, the diagnosis is often unclear and may appear as lichen planus. Some pathologists will diagnose this as "Lichenoid Mucositis" or others may indicate just "a lichenoid reaction." Documenting any tissue changes by making before and after images of the tissue will usually answer this question. A dermatologist can determine if metal sensitivity may be an issue and conduct epicutaneous patch testing. Some dental facilities who engage a dermatologist may include this procedure as part of a normal protocol when there is any question about the etiology and its relationship to oral sensitivity.

If a patient requires a restoration to be replaced, the dental provider will most likely use a newer material to replace an amalgam. If the restoration is broken or extremely defective, amalgam leakage could be a concern and there is a need to address this issue by replacing the restoration. Sometimes older amalgams will seal themselves - this is one of the benefits of the amalgam materials - or they may get decay under the amalgam. So, radiographs and clinical evaluation are always necessary to determine the need for replacing a possibly defective amalgam restoration.

A recent publication by the Canadian Medical Association 2016¹² suggests that physicians ask some key questions of patients who are concerned about mercury and are considering removal of their restorations. The physician would want to ask the patient about the number and integrity of the patient's restorations and his/her chewing habits including any bruxism. Questions concerning occupational exposure to mercury should also be addressed such as whether the person has worked around processes involving mercury. Inhalation and exposure to mercury is a concern as well. Fluorescent light bulbs (broken) is of concern and a source of Hg⁰. Some vaccines are a concern such as thimerosal, which is partly metabolized into



Figure 2.

Courtesy of Carol Perkins, BA, AS, RDH.



Figure 3.

Courtesy of Carol Perkins, BA, AS, RDH.



Figure 4.

Courtesy of Carol Perkins, BA, AS, RDH.

ethylmercury. Again, all exposure is cumulative, and some individuals will have more substantial accumulation than others. Some physicians do special tests for this in physical examinations when warranted.

Recent studies, 2017, and results from a five-year follow-up of patients who had high mercury concentration in their urine before amalgam removal were examined again at a later date. After removal of the amalgams, the patients reported improved health conditions. The study was considered subjective and based on patient reported data in a small study population. Other studies report an overall health improvement and believe there is a systemic allergenic/irritant potential in some patients¹³ (Sharma, et al. 2015). Recent publications by Tiwari, et al. 2018,¹⁴ reported improvement in lichen planus in a group of 23 patients with improvement of 19 patients when the amalgam restorations were removed and complete remission in 11 patients. Removal of amalgam material amounts to several considerations: With any amalgam removal, consideration of the patient includes the potential to swallow particles, breathing mercury vapors into the lungs and the release of Hg⁰ into the operatory.

The FDA (2015) suggests that the developing neurological systems in fetuses and young children may be more sensitive to the neurotoxic effects of mercury vapor. Therefore, pregnant women and young children may be more at risk. This, of course, would be a concern for dental professionals who work around mercury vapors in the dental office and especially those who may be pregnant or considering a pregnancy in the near future. Recent studies by Cariccio, et al. 2018²¹ discuss the involvement of mercury in neuronal damage in neurodegenerative diseases.

"Dental amalgam can emit mercury vapor. Mercury vapor, being highly volatile and lipid soluble, can cross the blood-brain barrier and the lipid cell membranes and can be accumulated into the cells in its inorganic forms. Methylmercury, though not found in dental amalgam, can pass through blood-brain and placental barriers, causing serious damage in the central nervous system."¹⁷

Other Mercury Sources:

The FDA and EPA has suggested that consuming fish (CH₃Hg) with potentially higher mercury levels should be avoided. Fish such as tilefish from the Gulf of Mexico; shark; swordfish; orange roughy; bigeye tuna; marlin; and king mackerel are known to have higher levels of mercury. Generally, the larger fish are more of a concern. Lower levels of mercury are found in seafood such as: shrimp, pollack, salmon, canned light tuna, tilapia, catfish, and cod. The FDA states that mercury from dental amalgam and other sources (e.g., fish) is bio accumulative in organs. Therefore, limiting the exposure to added mercury sources is optimal. This could be a prime consideration for patients who have exposure to mercury or those who have multiple amalgam restorations.

Positions by Organizations

This publication is **not** to promote amalgam removal. Since some patients may request removal of their amalgams with the hope of improving their overall health, some safety tips are warranted in the event the patient and the dentist select to remove the restorations. The following are suggestions to consider when a decision to remove amalgam has been made by the dental professional and the patient. Removal of the amalgam, emits a vapor of elemental mercury that can be absorbed through the lungs. High levels are associated with adverse effects in the brain and kidneys. So, in the event of removal, safety issues should be in place. These safety issues have evolved over time. As we have learned more, additional regulations and suggestions have been added. One such finding is the inclusion of amalgam separators that is mandated by the EPA.

Amalgam Separators and Legislation: EPA Mandate

David Mendlik with DDSHgSolutions makes the following recommendations:

Chairside amalgam separator for the ease and efficacy of the EPA mandate:

When old fillings are drilled, spent amalgam enters the chairside cuspidor and drains into

municipal sewer and septic systems. The EPA's reinstated final rule on amalgam separators has mandated that all existing dental practices have amalgam separators installed on dental engines by July 14, 2020. This will reduce the impact of amalgam used and will reduce waste amalgam and its environmental impact.

Dental offices must use either an ISO 11143:2008 certified amalgam separator or an ANSI/ADA Standard No. 108 for amalgam separator at a separation rate of 95% or greater. Dental offices must employ the use of an amalgam waste bucket for the proper recycling of dry amalgam waste. Line cleaners must be between a pH of 6-8.

Chairside unit vs. central system: Keep in mind what kind of vacuum your dental office uses, wet or dry. Some amalgam separators are unsuited for "wet" evacuation systems. The best ones will work with either kind of vacuum. Some amalgam separators require the services of a plumber and/or electrician to get up and running. Many of the best units can be a DIV project and are designed with the simple concept of connecting to the dental engine by the dentists themselves.

The Following Organizations Appear to be Cohesive in Their Overall Recommendations

The FDA does not suggest amalgam removal when the restorations are not cracked, leaking or there is no evident decay under the amalgam.

The American Dental Association states in a position paper:

Based on the results of a comprehensive review, the Council reaffirmed at its July 2009 meeting that the scientific evidence supports the position that amalgam is a valuable, viable and safe choice for dental patients.

Statement adopted by the ADA Council on Scientific Affairs, August 2009

The Canadian Dental Association in its position paper states the following:

"It is considered unnecessary and ill-advised to replace functional or serviceable dental amalgam fillings (restorations) for safety concerns or perceived health needs. A conservative approach to filling replacement, combined with effective

decay prevention, is strongly advised to help maintain the dentition over a lifetime."

Protocol in Amalgam Removal

When removing amalgam, consider the following in your discussion:

- The dental facility should discuss the steps involved in the removal of the amalgam restorative material with the patient.
- Determine if any of the amalgams are cracked, leaking or if there is decay under the "filling" material (Figures 2-4).
- If removal is suggested because of a defective restoration, the following questions/actions are suggested as the most appropriate protocol to consider. Other sites mentioned in this course contain more detail and suggestions to limit mercury exposure and specific questions or answers for both the patient and the provider.
 - Is high speed evacuation with water used?
 - Will a rubber dam be used to limit swallowing of the material?



Figure 5.

Courtesy of Carol Perkins, BA, AS, RDH.

- Is some barrier protective device used over the nose of the patient to limit inhaled materials such as mercury vapor and particles? Some dentists have the patient breathe in oxygen during this removal process. Special masks are available for the patient to wear during the procedure.
- Will clothing be covered so that amalgam materials are not carried home to those contacts of the patient or to those out in the general community?
- Is eye wear used to limit debris and particles contaminating the eyes of the

patient? Eye wear worn by the patient and practitioner is standard in most offices.

- Does the dental professional believe he/she is equipped to handle amalgam removal? Some clinicians may prefer to send the patient to another facility that handles amalgam/mercury removal and maintains proper disposal more frequently.
- Is there high filtration in the operatory that is used for removing the amalgam? Some dental professionals will open the window as well, so that fresh air comes into the operatory. Again, depending upon location and the season, this is sometimes not the most conducive option.
- What material will be placed in the tooth after removal of the amalgam? Most offices in the United States have opted for non-amalgam restorations at this point. But, since the regulations still permit amalgam, this is something that should be discussed with the patient as well as any alternative restorative materials.

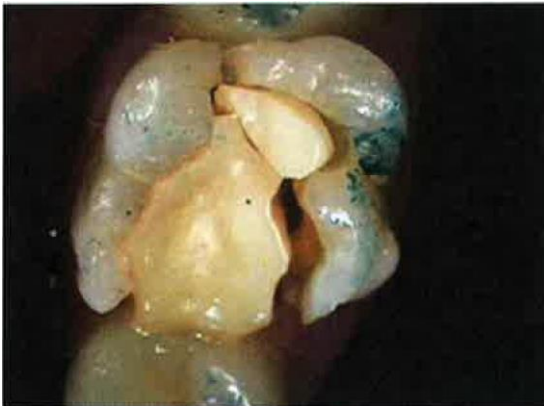


Figure 6. Depicts a defective composite restoration that should have had a crown originally.

Courtesy of Carol Perkins, BA, AS, RDH.

- The International Academy of Oral Medicine and Toxicology²¹ has specific guidelines that were updated in December 2016 for the removal of amalgam restorations. These guidelines can be found at www.thesmartchoice.com.
- The California Dental Association has specific recommendations and statements related to [*Best Management Practices for Amalgam Waste*](#) that have been updated in 2016.²²

Conclusions

In summary, it appears that when amalgams do need to be replaced, selecting a dental professional who is cognizant and informed about mercury vapor potential is important in patient safety and the safety of the staff. The consensus appears to be that replacement is only recommended when there is breakage, leakage and decay involved. In certain instances, when determined, removal of an amalgam may be conducted because of sensitivity to the materials in the alloy. Removal of the amalgam allows the release of mercury vapors into the operatory and inhalation into the lungs of the patient. Current research documents the fact that mercury can cross the blood brain barrier and mercury vapors are of a prime concern. When specific protocol is not followed, the entire team may be unnecessarily exposed to mercury vapors. This is especially of concern to staff members who may be pregnant and others who are exposed long-term to materials and vapors in the work environment. Patients who are informed about the amalgam removal process will certainly have a better outcome and be able to plan for their needs at the time. Some states are required to provide brochures that address the restoration advantages and disadvantages. A dermatologist will be able to determine if metal sensitivity may be a factor in patients with possible lichenoid-type reactions such as those associated with oral lichen planus. Discussing these concerns and issues with your patient is a positive step in making good decisions involving any removal process and choices for replacement materials.

Even though most states do not require that patients be given material describing advantages/disadvantages of restorative materials, an ethical practice would see the benefit of providing this information to the patient and educating the staff about safe environmental practices. With new regulations requiring amalgam separators, the topic of amalgam toxicity and environmental concerns will continue to increase with both professional and public concerns. The knowledgeable dental professional will be key in addressing all of these issues with the patient and staff.

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: www.dentalcare.com/en-us/professional-education/lce-courses/ce557/satrt-test

1. **Amalgam restorations contain a mixture of which of the following materials? Select the best choice.**
 - A. Silver, copper, nickel, mixed with mercury
 - B. Copper, mercury, zinc, roodium and mercury
 - C. Silver, tin, copper, zinc mixed with mercury
 - D. Nickel, gold, copper mixed with mercury

2. **In early times, mercury was called _____**
 - A. shiny water
 - B. liquid silver
 - C. white gold
 - D. heavy water

3. **Dental amalgam has been a preferred material because of its _____**
 - A. durability
 - B. anti-caries properties
 - C. anti-corrosion properties
 - D. esthetic value

4. **According to the California Dental Association, mercury toxicity is determined by all of the following EXCEPT which one?**
 - A. The form of mercury
 - B. Duration of exposure
 - C. Dose and route
 - D. The overall health of the person

5. **The introduction of the amalgam filling material to the United States occurred in which of the following years according to an ADA timeline.**
 - A. 1800-1820
 - B. 1820-1830
 - C. 1830-1850
 - D. 1850-1870

6. **The European Level Guidance recommends the use of _____ restorations in posterior teeth when possible.**
 - A. amalgam
 - B. resin composites
 - C. gold crowns
 - D. sealants

7. **A major factor cited for the consideration of amalgam in posterior teeth by European countries is due to which organization?**
 - A. The Academy of General Dentists
 - B. The National Health Service
 - C. The World Health Organization
 - D. The European Medical Association

- 8. Amalgam usage Is banned in which of the following countries?**
- A. Germany and Denmark
 - 8. Sweden and Germany
 - C. Denmark and Norway
 - D. Norway and Sweden
- 9. Some countries have restrictions on the use of amalgam in certain patients. Which of the following is the correct list of considerations?**
- A. Pregnant women, children under certain ages, lactating women.
 - 8. Older individuals, AIDS patients, pregnant women
 - C. Any patient under the age of 20, pregnant women
 - D. Lactating women, pregnant women and medically compromised patients.
- 10. A primary target in Hgo exposure in children is:**
- A. The brain
 - 8. The kidneys
 - C. The Central nervous system
 - D. All of the above .
- 11. The states mentioned In this CE that require brochures and pamphlets stating the advantages and disadvantages of both amalgam and resin restorations is which of the following:**
- A. Maine, Connecticut, California
 - 8. Maine and New Hampshire
 - C. New Jersey, New Hampshire and California
 - D. Wisconsin, Texas and North Carolina
- 12. Which of the following is not considered a reason for replacing amalgam restorations?**
- A. A fracture
 - B. Marginal defect
 - C. The age of the amalgam
 - D. Tissue reaction
- 13. Sensitivity to a metal such as amalgam may be mistaken for which of the following?**
- A. Dermatitis
 - 8. Lupus
 - C. Lichen planus
 - D. Kidney disease
- 14. The Canadian Medical Association suggests that patients who are concerned about mercury and considering removal of their restorations, be asked some key questions: Which is the most appropriate question (s) that you would want to ask?**
- A. The number and integrity of the restorations
 - 8. The occupational exposure to mercury
 - C. Inhalation of mercury compounds
 - D. Vaccines
 - E. All of these are appropriate.
- 15. All exposure to mercury is cumulative whether elemental or methlymercury.**
- A. True
 - 8. False

- 16. Khwaja et al. 2016 suggests that there should be an increase in what area?**
- A. The use of resin composites
 - B. Better training in placing amalgams-increasing better techniques
 - C. Minimizing mercury exposure
 - D. Nutrition practices of children
- 17. Many offices have stopped using amalgam because of:**
- A. Vapor exposure in the practices
 - B. Medical complaints related to the effects of mercury-related issues.
 - C. The cost of amalgam materials
 - D. The improvement of comparable dental materials such as composites
- 18. Patients with oral lichen planus may have more dental amalgams than other groups because:**
- A. The teeth may have had more caries due to steroid medications
 - B. They are in an older age group and may have more amalgams
 - C. Nutrition may be a part of their etiology of OLP
 - D. There may be more bruxism involved in this group of patients
- 19. The FDA in 2015 suggests that the neurological systems of fetuses and young children may be more sensitive to the neurotoxic effects of mercury vapor.**
- A. True
 - B. False
- 20. High levels of methylmercury may be found in which of the following fish?**
- A. Salmon
 - B. Shrimp
 - C. Swordfish
 - D. Cod
- 21. Both methylmercury and elemental mercury are cumulative and can pass the blood brain barrier.**
- A. True
 - B. False
- 22. Amalgam separators must be properly installed by which date?**
- A. July 2019
 - B. July 2020
 - C. July 2021
 - D. July 2022
- 23. The United States, Finland, Australia, Sweden are cited as having adopted the use of resin composites in the posterior teeth. Which other country should also be added to this list?**
- A. The UK
 - B. France
 - C. Iceland
 - D. Poland

24. **When removing amalgam restorations, a rubber dam _ _ _ _ _**
- A. keeps the tooth dry and reduces contamination
 - B. contains old amalgam restoration material so that it is not swallowed by the patient
 - C. isolates the area for better viewing
 - D. is optional
25. **Patients whose clothing is not adequately covered during amalgam removal may bring amalgam material on their clothing home to family members, the community and be exposed themselves to this residue.**
- A. True
 - B. False
26. **After the 1970's, a metal component used in mercury alloy was increased. Which of the following was increased?**
- A. Silver
 - B. Copper
 - C. Zinc
 - D. Tin
27. **The major problem (s) with removal of amalgam is which of the following?**
- A. The patient may swallow amalgam particles
 - B. There may be release of Hgo into the operatory
 - C. The patient breathes in the vapors to the lungs
 - D. All of the above are considerations.

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Additional Resources

- No Additional Resources Available

About the Author

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Dr. Burkhardt received a Bachelor of Science degree in dental hygiene from Fairleigh Dickinson University School of Dentistry, a Master of Education degree from North Carolina State University in Occupational Health Education, a Doctor of Education Degree from North Carolina State University in Adult Education/ Interdisciplinary studies. Nancy conducted a one-year postdoctoral fellowship in the section of Oral Pathology at the University of North Carolina School of Dentistry in Chapel Hill in the section of oral pathology. Her dissertation topic was "Oral Lichen Planus Commonalities: Educational and Psychological Implications." Dr. Burkhardt is an Adjunct Associate Professor and Educational Consultant in the Department of Periodontics/Stomatology at The Baylor College of Dentistry where she has been a faculty member since 1997. She is founder and faculty Co-Host of the International Oral Lichen Planus Support Group established in 1997.

Dr. Burkhardt has presented papers both nationally and internationally on Oral Lichen Planus/ Mucosal Diseases and has published articles in national dental journals. She is co-author of "General and Oral Pathology for the Dental Hygienist" published through Lippincott, Williams & Wilkins and the book is now in its 3rd edition 2018. She was a 2006 recipient of the ADHA Crest Award through Proctor & Gamble and The Philips Consumer Lifestyle and PennWell Corporation "Mentor of Distinction Award" in 2012. She is an Academic Affiliate Fellow of The American Academy of the Oral Medicine Association-awarded fellowship in 2016. Nancy is a 2017 recipient of the "Award of Distinction" through SUNSTAR and PennWell, Corporation and a 2017 "Dental Professional of the Year" recipient through The International Pemphigus and Pemphigoid Foundation. As a columnist for RDH magazine since 2007, she writes a monthly column titled, "Oral Exams/Oral Pathology" for the PennWell publication that appears in both dental and dental hygiene literature. To date, she has written more than 120 columns for the publication on oral pathology/oral medicine topics. She is a reviewer for several national dental journals and a representative on the JCDE from 2014-2018.

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