

Mercury leaching from amalgam

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ABSTRACT

Dental amalgam is one of the most commonly used restorative materials in dentistry and has been used for more than 150 years. It consists of about 50% elemental mercury and a mixture of silver, tin, copper, and zinc. Mercury is one of the most toxic non-radioactive elements and may be toxic even at low doses. The level of mercury vapor, which is emitted from dental amalgam restorations, markedly increases by chewing, eating, brushing, and drinking hot liquids. People with amalgam fillings are found to have high contents of mercury in their body which is mainly due to the leaching mercury during delayed expansion of the filling.

KEY WORDS: Amalgam, Restorative materials, Toxicity

INTRODUCTION

Dental amalgam is one of the most commonly used restorative materials in dentistry and has been used for more than 150 years.^[1] It consists of about 50% elemental mercury and a mixture of silver, tin, copper, and zinc. Mercury is one of the most toxic non-radioactive elements^[2] and may be toxic even at low doses.^[3,4] The level of mercury vapor, which is emitted from dental amalgam restorations, markedly increases by chewing, eating, brushing, and drinking hot liquids.^[5] Dental erosion has been a growing health problem^[6,7] which may be due to monumental increase in the consumption of carbonated drinks, sports drink, and even fruit juices in the UK, the US, and several other countries.^[8] Corrosion of alloys occurs in oral environment and the biocompatibility of these dental alloys is a critical issue because they have long-term intimate contact with oral tissues. The biocompatibility may correlate with elements of dental alloys. The release of elements from dental alloys may cause adverse biological effects. A reduction in pH will also increase elemental release from the dental alloys, but the release of elements from the alloys may correlate with various other factors.^[9,10] People with amalgam fillings are found to

have high contents of mercury in their body^[11] which is mainly due to the leaching mercury during delayed expansion of the filling. Removal of amalgam restorations may significantly affect mercury levels in the plasma and urine.^[12]

COMPOSITION OF AMALGAM

Conventional dental amalgam contains 67% silver, 25% tin, 6% copper, 2% zinc, and 3% mercury.^[13] Dental amalgams are of two types; (1) low-copper and (2) high-copper amalgam. Low-copper amalgam has now been replaced by high-copper amalgam as it has high strength, less corrosion, and tarnish, produces less creep and it also has less chances of marginal failure.^[14] Most dental amalgams is a mixture of silver and tin in the ratio of 3:1 and they usually have less proportions of copper and zinc. Silver increases the strength of the alloy and causes expansion. Tin decreases the strength and expansion and lengthens the setting time. Copper increases the strength, reduces tarnish and corrosion, and reduces the creep, thus reducing the marginal deterioration. Zinc is added to prevent the oxidation of the other metals and also prevents the alloy from turning dark. Mercury in amalgam vapors when in the body and will pass rapidly through the cell membranes, crosses the blood-brain barrier, and reaches the central nervous system. The effects of this might cause immunological and psychological problems.^[15]

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MERCURY LEACHING

Restorative fillings are subjected to a variety of changes in the oral environment; few of which can cause corrosion. Some of the metal elements have higher tendency to be released from fillings which are based on the composition of filling, nature of the element, and other biological liabilities. Several materials and methods were used in different researches to study about the release of elements from the fillings.^[16,17] The previous studies have proved that the level of carbonation may not be responsible for the erosive effect of different drinks.^[18] One more study explained that the type of acid may be responsible for the pH change.^[19] The non-cola drinks and fruit juices mainly contain citric acid while in the cola drinks or carbonated drinks, phosphoric acid is added and interestingly, *in vitro* studies have proved that citric acid causes more erosion than phosphoric acid^[20] and cola drinks despite having a change in the pH after opening can be neutralized easily that the non-cola drinks and fruit juices.^[21,22] It is proved in another study that non-cola drinks are more erosive than cola drinks or carbonated drinks.^[23]

EFFECTS OF MERCURY FROM AMALGAM ON ORAL HEALTH

Vapors of mercury may be released from condensation, carving processing, and removal of the amalgam filling apart from the erosion caused by beverages. Proper condensation of amalgam can significantly reduce (6–10%) the mercury release from amalgam.^[24] Mercury can rarely cause localized problems in the oral cavity such as oral lichenoid lesions (OLLs).^[25] Mercury causes three medically significant reactions: (1) Type 4 hypersensitivity reaction, (2) toxic reactions, and (3) acute and generalized reaction which is rare.^[26]

Mercury Allergy

Usually, mercury allergy is not tested on patients before they are used as restorative material. A survey shows that the patients are not aware of the fact that amalgams can cause systemic diseases after being used a restorative material.^[27] Symptoms of an amalgam allergy may include skin rashes, swollen lips, and localized eczema-like lesions in the oral cavity. In some cases, they might disappear within a few days while sometimes the amalgam restoration will have to be removed and be replaced by an alternative restorative material.^[26]

Mercury Toxicity

Any kind of toxic reactions may occur if an irritant is in direct contact with the mucosa over several years. They might resemble OLLs (inflammatory and precancerous conditions) that are caused due to

hypersensitivity reactions and these toxic reactions are more common in amalgams with higher zinc content.^[28] To determine if a person is poisoned, the blood levels and urine levels measured and observed to be excess.^[15]

Amalgam Tattoos and Amalgam Blue

Amalgam tattoos which are the most common localized pigmented lesions of the oral cavity are areas of discoloration caused by the migration of particles of dental amalgam due to the traumatic implantation of dental amalgam into the soft tissues, which then become embedded under the oral membranes, causing a gray, black, or blue patch.^[29] Amalgam tattoos can also be caused accidentally.^[2]

A tooth that has been filled with amalgam will weaken overtime and result in the gray-blue appearance of the enamel referred to as amalgam blue which mostly mimics secondary caries. It occurs mostly due to the leakage of amalgam from the restoration and can penetrate and corrode the dentinal tubules.^[30]

Gingivitis

The restorative material on tooth surfaces is one of the major causes for periodontal diseases.^[31] It is found that plaque adhesion is more in the restorative material than on the enamel of the tooth.^[32] The formation of plaque either on the restoration or on the tooth may invariably affect the adjacent soft tissues and might cause inflammatory reactions.^[33]

CONCLUSION

Proper usage of amalgam as in proper condensation and carving of amalgam can greatly reduce the amount of mercury that is released thus preventing damage. Usage of suction devices and sprays may also possibly reduce the contamination of restoration in the oral cavity. Amalgam can also be replaced by esthetic restorative materials such as glass ionomer cement and composite and other restorative materials such as porcelain and gold.

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