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RESEARCH ARTICLE

INNOVATIONS IN AMALGAM WASTE MANAGEMENT

Shreya Asija

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Abstract

The use of amalgam is being phased out due to the increased awareness of its impact on health and the environment. Despite this, amalgam is still used in many dental practices if it is clinically indicated. Even if some dentists don't personally use it, they may still encounter patients who have amalgam restorations. So, the dental practices that do handle it must still ensure compliance with amalgam disposal regulations by segregating and disposing of the material to the highest standard. Thus, new innovations are being developed to enable dental professionals to dispose of amalgam waste in a safe and effective manner.

Introduction:-

Amalgam is a metallic polycrystalline alloy containing liquid mercury with an alloy made of silver, tin, and copper solid particles. It is a commonly used restorative material in dentistrydue to its low-cost is of application, strength, durability and bacterio-static effect. It can be used in stress bearing areas and in poor oral hygiene conditions where aesthetic isn't concerned. But concern has been raised due to its Mercury toxicity. The current occupational safety and health administration standard for mercury is 0.1 mg per meter of air averaged over eight hours of work shift.

Mercury management in dental clinics is a critical aspect of ensuring the safety and well-being of both patients and dental professionals. Mercury, a potent neurotoxin, is commonly used in dental amalgam fillings due to its unique properties. However, the improper handling and disposal of mercury in dental clinics can pose significant risks to human health and the environment. Dentist and dental nurses are at a risk of potential exposure to the mercury. A recent survey showed that dentists are found to have on an average over four times the level of urinary mercury.

There is growing concern about the potential health and environmental impacts associated with mercury release. When dental amalgam waste is improperly managed, it can lead to the release of mercury into the air, water, and soil, contributing to pollution and posing risks to ecosystems. It can be exposed in dental clinic by the means of storage of mercury, preparation and placement of amalgam restoration, polishing silver amalgam restoration, removal of amalgam filling.

To prevent patients, dentists, and dental nurses from being exposed to mercury, it is necessary to follow the mercury management protocols and methods described in this review article.

Mercury Toxicity Effects:

Neurological effects	memory loss decrease in mental function delusions

Corresponding Author:- Shreya Asija

	delirium hallucination
Dermatological effects	erythematous peeling skin exanthematous pustulosis erythematous maculopapular rash
Endocrine effects	irritability abnormal responses to stimulation emotional instability
Psychological issues	mood swings anger depression irritability nervousness Fatigue Headaches Hearing loss Immune system impairments Insomnia Nerve response changes decreased coordination weakness atrophy twitching
Oral manifestations	Gingivitis metallic taste oral lichenoid lesion Coughing Trouble breathing Metallic taste in your mouth Nausea or vomiting Bleeding or swollen gums Reduced salivation

Means Of Exposure Of Mercury In Dental Clinics:

1. Storage of mercury
2. Preparation and placement of amalgam restoration.
3. Polishing silver amalgam restoration
4. Removal of amalgam filling

Absorption, Transportation and Excretion in the Body:

Absorption of mercury	**Elemental**	**Inorganic**	**Organic**
Lungs	**80%**	**80%**	**----------**
Gastrointestinal tract	**0.01%**	**7%**	**95-98%**

Methods To Detect Mercury Vapour Release:

1. Mercury thermometer.
2. Jerome mercury vapours detectives
3. Gold film mercury vapour detectives
4. Twin cell photo acoustic mercury detector
5. Atomic absorption mercury detector.
6. Scanning electron microscopy (SEM) and energy dispersive, x-ray analysis (EDXA) of sectioned teeth with amalgam

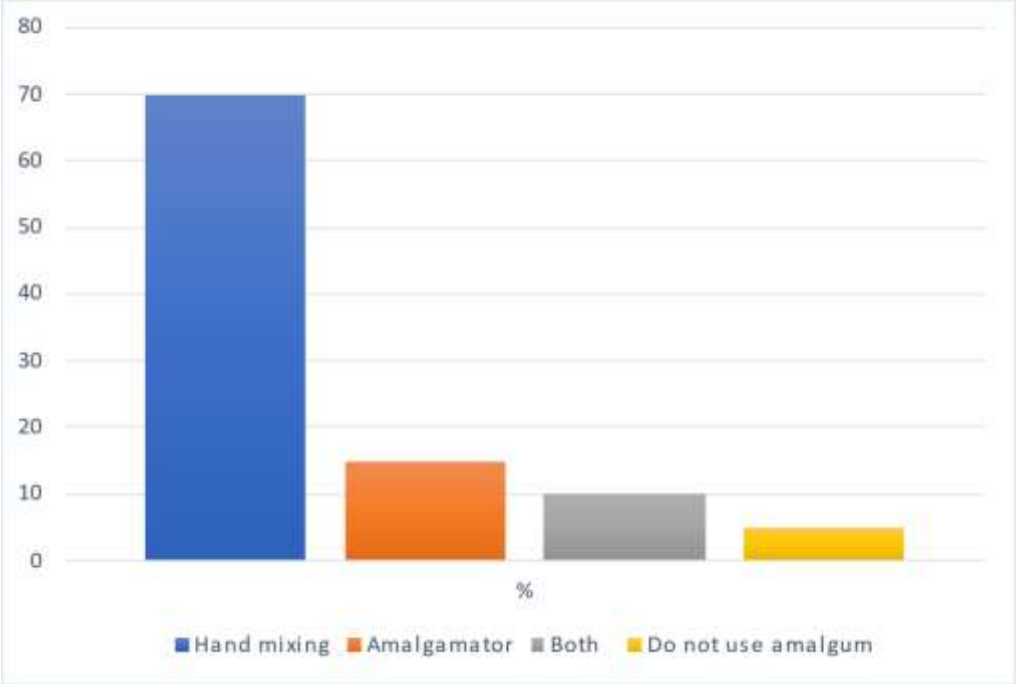
7. Perkins Elmer flow infection mercury system.

Mercury Exposure Hazards and Risk Management:

It is seen that, most mercury released into the mouth isswallowed and passes into gastrointestinal tract. This mercury is oxidized to less toxic mercury ion (Hg+2) and about 5-10 % is absorbed.

1. Mercury vapour from dental amalgam restoration results in absorption of 1 µg / day in lungs.
2. Amount of mercury swallowed - >1 µg/day is absorbed by GIT.
3. Threshold for absorption of mercury vapor by lungs: 20 µg / day.
4. Threshold for GIT absorption: 400 µg / day.

Dispensing form of amalgam used by dentists:



Dentists response:
Hand mixing 70%
Amalgamator 15%
Both 10%
Do not use amalgam 5%

Mercury Deposits Maybe Found In

1. Spinal ganglion: neurons and satellite cells.
2. Anterior pituitary: Secretary Cells
3. Adrenal medulla: Chromatin cells and macrophages
4. Pancreas: Islets of Langerhans.
5. Liver: Hepatocytes and Kupffer cells.
6. Kidney: Proximal tubular cells.
7. Lungs: Macrophages
8. Lymph glands: Macrophages

Mercury Management:

Equipment for Clean-up of Small Spills

1. Nitrile Gloves
2. Paper Towels
3. Flashlight

4. Zipper Style Plastic Bags
5. Rubber Squeegee
6. Plastic Dust Pan
7. Plastic Trash Bags
8. Wide-mouth plastic container with screw on lid large tray or box
9. Eye dropper, turkey baster
10. Index cards, playing cards, rigid paper
11. Sulphur Powder
12. Electrical or Duct Tape

To prevent spreading contamination, do not allow employees with mercury contaminated clothes to walk around, the affected person must remain in the room. Contaminated shoes and clothing should be placed in a plastic bag and do not launder them.

Proper disposal procedures should be undertaken. if anyone comes in contact with mercury should shower with water and soap. To clean the spillage, do not use a vacuum. This can lead to even spread of it.

Before the restoratory procedure, one should remove all the jewellery as the mercury get adhered the metal and change into old clothing.

Disposal & Recycling
The hazardous waste contract is not required for recycling mercury. The District Waste Management Coordinator has a list of facilities approved by the MnDOT Office of Environmental Stewardship that can accept mercury for recycling and disposal.

Storage Guidelines
Place the contaminated material container in the district hazardous waste storage building.

Transportation and Documentation
Mercury can be transported by MnDOT personnel but must be recorded on a MnDOT shipping paper or a waste-tracking invoice that contains the following information: date of shipment, storage location and drop-off destination, quantity of mercury shipped (in weight or number of items).

Treatment Of Mercury Toxicity:
The physician must be able to recognize the clinicalmanifestations of mercury intoxication and understand theimportance of biological markers in making a definitive diagnosis of mercury poisoning.

In a desire to treat the patient complaining of symptoms similar to some that can be caused by mercury, a growing number of physicians, particularlythose in alternative medicine fields, result to chelation to "rid" the body of the mercury, believed to be the cause of the ailments. And although the use of chelation is increasing, controlled studies showing that this procedure actuallyimproves outcome are lacking. If chelation therapy isconsidered to be indicated, the attending physician shouldcommunicate the risks of chelation to the patient before beginning treatment with metal-chelating drugs16. There are two goals to treatment.

First, get rid of the mercury, second, control symptoms so you can be comfortable and productive during the prolonged period whenmercury is removed andhealing takes place. In order to control the symptoms, it isnecessary to identify the metabolic defects mercury is causing for you.

Either 2,3-dimercaptosuccinic acid (DMSA), 2,3-dimercaptopropanol (BAL), 2,3-Dimercapto-1-propanesulfonic acid, DimAval (DMPS) or N-acetyl-D, L-penicillamine (NAP) can be used in the treatment of mercury poisioning.17 Meso-2,3-dimercaptosuccinic acid (DMSA) is a sulfhydryl-containing, water-soluble, non-toxic, orally-administered metal chelator which has been in use as an antidote to heavy metal toxicity since the 1950s.

More recent clinical use and research substantiates this compound'sefficacy and safety and establishes it as the premier metal chelation compound, based on oral dosing, urinary excretion and its safety characteristics compared to other chelating substances18. Using a proper protocol, e.g. DMSA every 3-4 h on alternate weeks; 2-6 months to

feel better; then DMSA + L.A. every 3-4 days every week or two to clear the brain and internal organs, 2-6 months to feel better. Continue supplements and diet control with continuingDMSA + LAchelation while healing takes place. Moderately poisonedpatient is feeling depressed, tiredand icky. 6-11 months of DMSA + LA treatment.

It cures immediately, if taken right supplements and medicines, but chelationis required to get rid of the mercury. · In case of chronic fatigue, fibromyalgia, environmentalsensitivities, severe allergies or asthma, emotional disturbances, 14-25 months of DMSA-LA required. · In case of multiple chemical sensitivities, chronic fatigue syndrome, serious emotional disturbances – seriously poisoned - > 20-36 months of DMSA + LA. · To reduce the chances of future problems, neurological disease, or premature aging and to remove more mercury from the brain, chelate with DMSA + LA for 6 months to a year. DMSA was able to increase the excretion of mercury to agreater extent than NAP.

Acute Hg intoxication can be managed with BAL as first choice chelator, whereas the lesstoxic 2,3-dimercaptosuccinic acid (DMSA) and 2,3-dimercaptopropane-1-sulfonic acid (DMPS) should be reserved for cases of less severe inorganic Hg or methyl-Hg acute intoxication. Such agents, recommended only for the treatment of acute Hg poisoning, should not be used forpatients suffering from neurological diseases in which environmental Hg exposure is hypothesised.

Conclusion:-

Amalgam can be used as a good restorative material for almost all the classes of cavity but due to its Mercury toxicity, it is now being used less. Mercury can cause neurological effects, dermatological effects, endocrine effects, psychological issues and many oral manifestations. Hence, there should be a proper disposal and management of the spillage in order to prevent all these complications. Biological determination can be performed on personnel using mercury to measure mercury levels in blood and urine. The risk of mercury exposure to such personnel cannot be ignored but close adherence to simple hygiene procedures helps ensure a safe working environment. Mercury can give rise to a logic and amino logic reactions which may be genetically transferred, in the absence of adequate those response studies for women in logical sensitive individuals. It has not been possible to set a level for mercury in blood or urine below which mercury related symptoms will not occur. The most significant contribution to mercury assimilation from dental amalgam is via vapour phase. Therefore, certain interceptive and preventive measures have to be undertaken to prevent mercury toxicity and its harmful effects.

Discussion:-

Mercury management in dental clinics is an important topic that involves the proper handling, storage, and disposal of mercury-containing dental waste. Mercury is commonly used in dental amalgam fillings, which are a mixture of silver, tin, copper, and mercury. However, if not managed carefully, mercury can pose environmental and health risks. One of the key aspects of mercury management in dental clinics is the implementation of best practices to minimize the release of mercury into the environment. These practices include using high-efficiency amalgam separators to collect mercury-containing waste, employing proper ventilation systems, and implementing appropriate spill prevention and clean-up procedures. Amalgam separators are devices that capture and remove mercury from wastewater generated during dental procedures. They are installed in the suction lines of dental units to collect the amalgam particles and prevent their release into the sewage system. Regular maintenance and monitoring of these separators are essential to ensure their effectiveness. Proper storage and disposal of mercury waste are crucial to prevent contamination of the environment. Dental clinics should have dedicated containers for collecting and storing mercury-containing materials such as used amalgam capsules, old amalgam fillings, and leftover amalgam. These containers should be labelled and kept in a secure area to prevent accidental spills or leaks. When it comes to disposal, dental clinics must comply with local regulations and guidelines regarding the disposal of mercury waste. Many jurisdictions have specific requirements for the disposal of mercury-containing dental waste. This may include working with licensed waste management companies or specialized recyclers who can handle and recycle mercury-containing materials appropriately.

It's also important for dental professionals to educate themselves and their staff about the proper handling and management of mercury. Training programs and workshops on mercury hygiene, spill management, and waste handling should be conducted regularly to ensure everyone is aware of the best practices and protocols. In recent years, there has been an increased focus on reducing mercury use in dental clinics through the adoption of alternative restorative materials. Tooth-coloured composite resins and ceramics are becoming more popular as

mercury-free alternatives to amalgam fillings. Dental professionals can consider the use of these materials based on their patients' needs and preferences.

Overall, mercury management in dental clinics requires a proactive approach to minimize the environmental impact and protect human health. By implementing proper protocols, using amalgam separators, ensuring appropriate storage and disposal, and exploring mercury-free alternatives, dental clinics can contribute to a safer and more sustainable dental practice.

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