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RESEARCH ARTICLE

BIOMEDICAL WASTE MANAGEMENT IN THE DENTAL CLINICS DURING THE COVID-19 PANDEMIC

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ABSTRACT

Biomedical waste management is one of the emerging causes for Hospital Acquired Infection, which is very important to deal with due to its significant impact on the health and environment. Biomedical waste generated in dental clinics and hospitals if not managed properly, can create various health hazards to dental professionals, dental auxiliaries, patients and other dental health care service providers who work in dental office. Each dental health care provider should have knowledge about handling and disposal of biomedical waste. In this article different methods of handling and disposal of biomedical waste during the unprecedented times of COVID-19 are elaborated. Revised guidelines are provided by central pollution control board (Govt of India), American dental association, Centre for disease control, world health organization and other organizations dealing with waste management are discussed in this article.

KEYWORDS

Amalgam Scrap, Biomedical Waste, Infectious Waste, Pathological waste. COVID-19.

1. INTRODUCTION

Dental practices produce large as well as small amounts of Biomedical Waste (BMW) which has to be given equal importance in management (Benakatti and Kanathila, 2018). Therefore, proper management of Biomedical Waste is of prime importance. There are a number of dental wastes that, when disposed improperly, could prove hazardous to the environment as well as those who come in contact with the materials (Baghele et al., 2013).

According to Biomedical Waste (Management and Handling) Rules, 1998 of India, BMW (Biomedical Waste) is defined as "Any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological". BMW generated in dental office include plastic, latex, cotton, glass, amalgam waste, mercury, X-ray processing solutions, lead foils, disinfectants, chemicals, dental casts and impressions, waste sharps like surgical needles, blades, extracted teeth, human tissues, discarded, expired medicines and dental materials. All these materials pose high risk as they are saliva and blood contaminated which carry disease spreading microbes.

The steps for the handling of biomedical waste include the generation, sorting, segregation, use of color coded waste disposal bags, collection, storage, packaging, loading, transportation, unloading, processing, treatment, destruction, conversion, or offering for sale, transfer, disposal of such waste (Biomedical Waste Management, 2016). It is the responsibility of every dentist to ensure that biomedical waste is handled and disposed in a safe manner.

2. OBJECTIVES OF BIOMEDICAL WASTE MANAGEMENT

1. To prevent transmission of disease from patient to patient, from patient to health workers and to prevent injury to the health care workers in support services, while handling biomedical waste.

2. To prevent general public exposure to the harmful effects of the cytotoxic, genotoxic, and chemical biomedical waste.

Source: Thota et al., 2014

3. CLASSIFICATION OF HEALTH-CARE BMW

Several classifications of health-care waste have been put forward. One such classification divides hospital waste into hazardous and non-hazardous[1] (Table 1) There are various categories of hospital waste, but some are important for dental care workers. Waste categories and description as suggested by World Health Organization (Pruss et al., 1999), is given in Table 2.

Table 1: Hazardous & Non-hazardous waste

HAZARDOUS WASTE	NON-HAZARDOUS WASTE
Infectious waste	Disposable paper towels
Pathological waste	Disposable covers of operating surfaces
Sharps	Paper mixing pads
Chemical waste	
Cytotoxic waste	
Radioactive waste	

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Table 2: Who Classification Of Health Care Waste

	Waste category	Description with examples
1.	Infectious waste	Waste suspected to contain pathogens; e.g., laboratory cultures, tissues, swabs, materials or equipment that have been in contact with infected patients, excreta, etc
2.	Pathological waste	Human tissues or fluids; e.g., body parts, blood and other body fluids, fetuses, etc Sharp
3.	Sharps	Sharp waste; e.g., needles, scalpels, blades, knives, infusion sets, broken glass
4.	Pharmaceutical waste	Waste containing pharmaceuticals; e.g., pharmaceuticals that are expired or no longer needed, items contaminated by or containing pharmaceutics (bottles, boxes)
5.	Genotoxic waste	Waste containing substances with genotoxic properties; e.g., cytotoxic drugs (cancer drugs), genotoxic chemicals
6.	Chemical waste	Waste containing chemical substances; e.g., laboratory reagents, film developer, fixer, disinfectants that are expired or no longer needed, solvents
7.	Radioactive waste	Waste containing radioactive substances; e.g., unused liquids from radiotherapy or laboratory research, contaminated glassware, packages or absorbent paper, urine and excreta from patients treated or tested with unsealed radio-nuclides, sealed sources
8.	Wastes with high content of heavy metals	Batteries, broken thermometers, blood pressure gauges, etc
9.	Pressurized containers	Gas cylinders, gas cartridges, aerosol cans

Table 3: Categories of biomedical waste, their segregation and disposal

3.1: Schedule I: Categories of biomedical waste (Ministry of Environment and Forests, 1998)

Option	Waste category	Treatment and disposal
Category no 1	Human anatomical waste (human tissues, organs, body parts)	Incineration* /deep burial†
Category no 2	Animal waste (animal tissues, organs, body parts, carcasses, fluids, blood, experimental animals, waste generated by veterinary hospitals, colleges, discharge from hospitals, animal houses)	Incineration* /deep burial†
Category no 3	Microbiology and bio-technology waste (wastes from laboratory cultures, stocks or specimens of micro-organisms, live or attenuated vaccines, human and animal cell culture and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer of cultures)	Local autoclaving/microwaving/ incineration*
Category no 4	Waste sharps (needles, syringes, scalpels, blades, glass, etc., that may cause puncture and cuts. This includes both used and unused sharps	Disinfection(chemical treatment‡/autoclaving/ microwaving and mutilation/shredding)
Category no 5	Discarded medicines and cytotoxic drugs (wastes comprising of outdated, contaminated and discarded medicines)	Incineration* /destruction and drugs disposal in secured landfills
Category no 6	Solid waste - Items contaminated with blood and body fluids including cotton, dressings, plaster casts, linen, beddings, etc	Incineration* /autoclaving/microwaving
Category no 7	Solid waste (wastes generated from disposable items other than the waste sharps such as tubings, catheters, intravenous sets etc)	Chemical treatment‡ /autoclaving/ microwaving and mutilation/shredding§
Category no 8	Liquid waste (waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)	Disinfection by chemical treatment‡ and discharge into drains
Category no 9	Incineration ash (ash from incineration of any biomedical waste)	Disposal in municipal landfill
Category no 10	Chemical waste (chemicals used in production of biologicals, chemicals used in disinfection, as insecticides, etc.)	Chemical treatment‡ and discharge into drains for liquids and secured landfill for solids

* There will be no chemical pre-treatment before incineration; Chlorinated plastics shall not be incinerated;
† Deep burial shall be an option available only in towns with population less than five lakh (5,00,000) and in rural areas;
‡ Chemical treatment using at least 1% hypochlorite solution or any other equivalent chemical reagent; It must be ensured that chemical treatment ensures disinfection;
§ Mutilation/shredding must be such so as to prevent unauthorized reuse

3.2: Schedule II: Color coding and type of container for disposal of biomedical wastes (Ministry of Environment and Forests, 1998)

Color coding	Type of container	Waste category	Treatment options as per schedule I
Yellow	Plastic bag	Category 1, Category 2, Category 3, Category 6	Incineration/deep burial
Red	Disinfected container/plastic bag	Category 3, Category 6, Category 7	Autoclaving/microwaving/chemical treatment
Blue/white translucent	Plastic bag/puncture proof container	Category 4, Category 7	Autoclaving/microwaving/chemical treatment and destruction/shredding
Black	Plastic bag	Category 5, Category 9, Category 10.	(solid) Disposal in secured landfill

1. Color coding of waste categories with multiple treatment options as defined in schedule I; Shall be selected depending on treatment option chosen; which shall be as specified in schedule I;
2. Waste collection bags for waste types needing incineration shall not be made of chlorinated plastics;
3. Categories 8 and 10 (liquid) do not require containers/bags;
4. Category 3 if disinfected locally need not be put in containers/bags

4. Steps Involved in Waste Management

Management of biomedical waste includes various steps like waste survey, waste segregation, accumulation and storage, transportation, treatment disposal and waste minimization (Table 4) (Park, 2009; Singh et al., 2014).

Table 4: Waste Management

Waste survey	Waste segregation	Waste accumulation and storage	Waste transport	Waste treatment	Waste disposal	Waste minimization
Quantify and differentiate waste	Different Waste placed in different containers	Accumulation is temporary holding and storage is longer holding of waste	Transport of waste in special containers in vehicles	Modify waste by disinfection or decontamination	Incineration, microwave irradiation, chemical disinfects, wet and dry thermal treatment, inertization and land disposal	Reduce, reuse and Recycle methods

5. Discussion & Management of Dental Care Wastes

The management of health-care wastes involves active participation and co-ordination between governmental and non-governmental bodies, the bureaucracy and the health care personnel. The BMW disposal in India is in nascent stages. Most standalone healthcare centers, including dental clinics, are becoming of the importance for the need of proper BMW disposal.

5.1 Dental Amalgam

It is a mixture of Mercury, Silver, tin and copper. It is known to be Neurotoxic, Nephrotoxic and bio cumulative element. Mercury which makes up the 50% of the compound is use to bind the metals together and to provide strong, hard, durable filling. Currently such fillings are hardly done in everyday practice due to various health hazards associated with the materials and the unesthetic appearance of the fillings. During the placement and removal of dental amalgam, restorations a variety of waste product is generated like elemental mercury vapor released from dental amalgam alloy, Dental amalgam scrap, Amalgam waste and Amalgam sludge. It should be disposed properly according to BMC guidelines (Table 5) (Singh et al., 2014; Singh et al., 2016).

Table 5: BMC guidelines

DO's	DON'T's
• Store unused elemental mercury in sealed containers.	• Never use a vacuum cleaner, broom or paintbrush or household cleaning products such as ammonia or chlorine
• Required amalgam amount should only be mixed or use premeasured amalgam capsules.	• Amalgam capsules, extracted teeth with amalgam restorations, cotton rolls and gauze with amalgam particle should not be incinerated.
• Use suction traps and disposable amalgam	• Do not place elemental mercury in the garbage
• Separators on dental suction units	• Never allow mercury to go down the drain.
• Use a "mercury spill kit" in case of a spill of mercury	• Do not walk around or leave the spill area until the contaminants are removed.
• Use mercury containers to store all scrap/old amalgam.	• Amalgam scrap should not be disposed with waste
• Always use gloves, mask, and glasses while cleaning the suction taps	
• Appropriate use of amalgam substitutes can be considered.	
• The container is to be labelled "hazardous waste: scrap amalgam	

Table 6: Various Dental Wastes & Their Management Options

Waste type	Source	Management options	Restrictions
Used X Ray Fixer Solution	X Ray processing	1) Dispose of through a silver reclamation facility or hazardous waste hauler. 2) Purchase your own silver recovery unit	**DO NOT:** **1)** Rinse down the drain
X Ray Developer	X Ray processing	1) Check with local wastewater treatment facility before discharging to sewer	**DO NOT:** 1) Mix X Ray developer and used X-Ray fixer 2) If mixing occurs, dispose mixture as hazardous waste
Containing X Ray System Cleaners	X-Ray system cleaning	1) Dispose of as hazardous waste 2) Switch to non chromium cleaners	**DO NOT:** 1) Rinse cleaners containing chromium down the drain
Lead Foils, Shields, and Aprons	X-Ray processing, protective shields	1) Dispose of as hazardous waste 2) Return to the original manufacturer (CWC) for recycling	**DO NOT:** 1) Place in trash 2) Place in the biohazard bag
Chemiclave/Chemical Sterilant Solutions	Sterilization of dental instruments	1) Dilute chemiclave solution with at least 4 parts of water, then rinse down drain – flush drain well	**DO NOT:** 1) Rinse undiluted chemiclave solution down the drain 2) Flush down septic system
Disinfectants and Cleaners	General office cleaning	Follow label directions for handling and disposal	**DO NOT:** 1) Flush down septic system
Alcohols, Ethers, Peroxides		1) Dispose of through a hazardous waste hauler	**DO NOT:** 1) Flush down drain or septic system
Fluorescent Bulbs		1) Recycle all fluorescent bulbs 2) Dispose of as hazardous waste	**DO NOT:** 1) Place in trash
General waste	Paper waste, cardboard and plastic containers, disposable uniforms.	1) Recycling all the paper waste, cardboard &plastic containers 2) Dispatch the soiled clothing to a commercial laundry, packed in red laundry bags and clearly labelled with a biohazard symbol	**DO NOT** 1) Reuse disposable uniforms.
Sharps		1. Sharps containers must be closeable, leak-proof and puncture-resistant and filled with 1% sodium hypochlorite as primary disinfectant. 2. Items are disposed off in a red color-coded bag to identify it as a hazard.	

5.2 Biomedical waste disposal during COVID-19 pandemic

The infectious nature of the COVID-19 virus has forced us all to take additional precautionary measures for all the frontline workers in the isolation & treatment centres. Following specific guidelines for management of waste generated during diagnostics and treatment of COVID-19 suspected / confirmed patients, are required to be followed by all the health employees including isolation wards, quarantine centers, sample collection centers, laboratories, and common biomedical waste treatment and disposal facilities, in addition to existing practices under BMW Management Rules, 2016 (Guidelines for Handling, 2020).

a. COVID-19 Isolation wards: (isolation wards are those where COVID-19 positive patients are being kept for treatment / diagnosis)

Healthcare Facilities having isolation wards for COVID-19 patients need to follow these steps to ensure safe handling and disposal of biomedical waste generated during treatment;

- ✓ Separate color coded bins labelled as "COVID-19 waste" (with foot operated lids) /bags/containers in wards and maintain proper segregation of waste as per BMWM Rules, 2016 as amended and CPCB guidelines for implementation of BMW Management Rules.
- ✓ As precaution double layered bags (using 2 bags) should be used for collection of waste from COVID-19 isolation wards so as to ensure adequate strength and no-leaks;
- ✓ Use dedicated trolleys and collection bins in COVID-19 isolation wards.The (inner and outer) surface of containers/bins/trolleys used for storage of COVID-19 waste should be disinfected with 1% sodium hypochlorite solution daily.
- ✓ Collect used PPEs such as goggles, face-shield, splash proof apron, Plastic Coverall, Hazmet suit, nitrile gloves into Red bag;
- ✓ Collect used mask (including Triple layer mask, N95 mask etc.), head cover/cap, shoe-cover, disposable linen Gown, non-plastic or semi-plastic coverall in Yellow bags.

b. Sample Collection Centers and Laboratories for COVID-19 suspected patients

Pre-treatment viral transport media, plastic vials, vacutainers, eppendorf tubes, plastic cryovials, pipette tips as per BMWM Rules, 2016 and collected in Red bags.

6. Conclusions

Improper disposal of biomedical waste in open space and water bodies leads to the spread of hazardous diseases. Clinical practices in modern dentistry take extreme care about the safe disposal of dental waste in order to safeguard healthcare workers and natural environment. If these harmful wastes are not properly disposed, it can affect not only the people in contact with it but also pollute the environment. It is very important to spread awareness training or educate people and convince them to adopt practices for REDUCE, REUSE AND RECYCLE rather than generating crap.

Safe and effective management of waste is not only legal necessity but also a social responsibility. Proper disposal of biomedical waste can reduce most of the health load in our country. It can be achieved by the proper awareness, implementation and utilization of the service provided by our government on the management of biomedical waste.

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