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BIOMEDICAL WASTE MANAGEMENT IN DENTAL OFFICE - A REVIEW

Dr. Veena B. Benakatti*[1] and Dr. Hema Kanathila[2]

[1]MDS Prosthodontics, Lecturer, Department of Prosthodontics, KAHE 'S KLE VK Institute of Dental Sciences, Kle University, Belagavi.
[2]MDS Prosthodontics, Reader, Department of Prosthodontics, KAHE 'S KLE VK Institute of Dental Sciences, Kle University, Belagavi.

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Corresponding Author: Dr. Veena B. Benakatti
MDS Prosthodontics, Lecturer, Department of Prosthodontics, KAHE 'S KLE VK Institute of Dental Sciences, Kle University, Belagavi.
Email ID: veenak20021@rediffmail.com,

ABSTRACT

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. An attempt has been made in this article to discuss different methods of handling and disposal of biomedical waste. Guidelines 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 considered in this article.

KEYWORDS: Amalgam Scrap, Biomedical Waste, Infectious Waste, Pathological waste.

INTRODUCTION

Dental practices produce large as well as small amounts of biomedical waste which has to be given equal importance in management. Both, quantity and type of waste generated in dental clinics are important. But lesser biomedical waste always means cost savings and more efficacious disposal system.

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 biologicals. 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.[1]It is the responsibility of every dentist to ensure that biomedical waste is handled and disposed in a safe manner.

Training should be provided to all health care workers, involved in handling bio medical waste at the beginning and updated every year. Immunization of all health care workers should be done who are involved in handling of bio-medical waste for protection against diseases.[1]

CLASSIFICATION OF BIOMEDICAL WASTE

The total waste produced by health services poses a potential risk to the patients, health professionals, the general population and the environment. Biomedical waste includes healthcare waste which is hazardous and capable of causing disease or injury. In dental practice, healthcare wastes include infectious waste, pathological waste, sharps, chemical waste, cytotoxic waste, radioactive waste and general office waste.[2] Non hazardous waste also forms a major part in dental practice which requires proper disposal. (Table 1).

Table 1: Classification of dental waste.

Hazardous waste	Non-Hazardous waste
Infectious waste Pathological waste Sharps Chemical waste Cytotoxic waste Radioactive waste	Disposable paper towels Paper mixing pads Disposable covers of operating surfaces

The most essential part of waste management is the segregation of Bio-medical waste. The color coding, type of container to be used for different waste category are listed below as per biomedical waste management rules-2016 by central pollution control board.[1](Table 2).

Table 2: Categories and color coding of bio-medical waste according to central pollution control board 2016 rules.[1]

Option	Waste Category	Treatment & Disposal	Color Coding
Category No. 1	**Human Anatomical Waste** (human tissues, organs, body parts)	Incineration @/deep burial*	Yellow colored non-chlorinated plastic bags
Category No. 2	**Animal Waste** (animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge from hospitals, animal)	Incineration @ / deep burial*	Yellow colored non-chlorinated plastic bags
Category No 3	**Microbiology & Biotechnology Waste** (wastes from laboratory cultures, stocks or specimens of micro-organisms live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer of cultures)	local autoclaving / micro-waving / incineration@	Yellow colored non-chlorinated plastic bags
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 @ 01/autoclaving / micro-waving and mutilation/ shredding"	White Colored translucent, puncture proof, leak proof, Temper Proof containers Note: Glassware and metallic body implants collected in Cardboard boxes with blue colored marking or blue colored puncture proof, temper proof containers
Category No 5	**Discarded Medicines and Cytotoxic drugs** (wastes comprising of outdated, contaminated and discarded medicines)	Incineration @/destruction and drugs disposal in secured landfills drugs disposal in secured	Yellow colored non-chlorinated plastic bags or containers
Category No 6	**Solid Waste** (Items contaminated with blood, and body fluids including cotton dressings, soiled plaster casts, lines, beddings, other material contaminated with blood)	Incineration @ autoclaving / micro-waving	Red Colored Non Chlorinated Plastic Bags
Category No. 7	**Solid Waste** (Wastes generated from disposable items other than the waste sharps such as tubings, catheters, intravenous sets etc).	disinfection by chemical treatment @ @ autoclaving/micro-waving and mutilation/	Red Colored Non Chlorinated Plastic Bags

Category No. 8	**Liquid Waste** (waste generated from laboratory and washing, cleaning, house-keeping and disinfecting activities)	Disinfection by chemical treatment@ and discharge into drains.	Yellow colored Non Chlorinated Plastic Bags
Category No. 9	**Incineration Ash** (ash from incineration of any bio-medical 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	Yellow colored containers or non-chlorinated plastic bags

World Health Organization (WHO) has classified medical waste into eight categories [3]:

1. General Waste
2. Pathological
3. Radioactive
4. Chemical
5. Infectious to potentially infectious waste
6. Sharps
7. Pharmaceuticals
8. Pressurized containers.

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.[4,5] (Table 3).

Table 3: Steps in waste management.[4,5]

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.

MANAGEMENT OF DIFFERENT TYPES OF DENTAL WASTE

1. General waste

General waste includes all the waste other than bio-medical waste and which has not been in contact with any hazardous or infectious, chemical or biological secretions and does not include any waste sharps. [1] Paper, cardboard, aluminum, plastics and general sweepings waste come under general waste. General office waste can be minimized by purchasing products with minimal packaging and use of both sides of pages can decrease the amount of paper used in dental office.[6] Paper waste, cardboard and plastic containers if clean, can be sent for recycling to those centers where such services exist. The dentist should dispatch the clothing to a commercial laundry, packed in red laundry bags and clearly labeled with a biohazard symbol or use disposable uniforms.

2. Infectious to potentially infectious waste

They include any material contaminated with blood or other body fluids containing pathogenic microorganisms, cultures and stocks of infectious agents. Blood and body fluid contaminated cotton and gauze is a hazardous waste, which should be collected in red or yellow biomedical waste bag and labeled with a biohazard symbol. This should be kept in refrigerator if not disposed in four days. Inform certified biomedical waste carrier for disposal, once the waste gets collected.[7]Wastes like cotton, gauze, suction tips, gloves, mask, suture materials, tissue swabs and dental impressions must also be placed in leak-proof bags and labeled appropriately.

3. Pathological waste

They include identifiable parts of human bodies like excised human tissues, tumors, extracted teeth.[2]A yellow biomedical waste bag is used to collect the pathological waste[1]. The waste should be double bagged and tied tightly. It must be labeled with a bio-hazard symbol and then a certified waste carrier is contacted for disposal. Medical lab specimens like biopsy samples of suspected oral cancerous lesions that have to be transported outside for evaluation should be kept in leak-proof bags and labeled correctly.

4. Sharps

They include any item having corners, edges, or projections capable of cutting or piercing the skin. The sharp waste in dentistry includes needles, syringes, scalpels, drills, blades, endodontic files, burs and orthodontic wires.[8,9] These sharp wastes should be handled with care in order to prevent accidental injuries. Needles should be mutilated by needle destroyer/ cutter, before disposing off syringes. Mutilated needles and other sharp wastes may be kept in white colored, puncture proof containers, with 1% sodium hypochlorite solution for primary disinfection and the solution should be changed after every 2 days.[10] Glass sharps should be collected in blue colored containers.[1]

OSHA has given specific guidelines related to sharps containers: [9]

1. Sharps containers must be closeable, leak-proof, and puncture-resistant. Items are labeled with a biohazard symbol or color-coded red to identify it as a hazard.
2. They should be capable of maintaining their impermeability during storage, transport, treatment, and disposal.
3. Sharps should be quickly placed into sharps containers after use.
4. Sharp containers should be replaced routinely before they get over filled.[11]

In order to minimize the potential for exposures, needles should not be recapped, bent, or broken by hand. Instead, a "hands-free" or a "one-hand*"* technique should be used. The hands-free technique which involves the use of a cap holder, allows the slipping of the needle into it without touching and getting injured.

5. Chemical waste

Among the chemical waste, dental amalgam requires the greatest care in handling, as metallic mercury represents 50% of the composition of this restorative material. The relationship between the handling of amalgam and contamination by mercury as well as the environmental contamination caused by amalgam residue, has already been established in dentistry. Dental amalgam particles as a source of mercury which is said be a neurotoxic, nephrotoxic, and bioaccumulative element. [5] It can easily get into the environment via waste water; scrap amalgam or vapors, if not disposed properly. There are few things to be followed for the handling of amalgam waste.[5,9](Table 4).

Table 4: Do's And Dont's for amalgam waste.[5,9]

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

6. Disinfectants and other Chemicals

Disinfectants can be discharged directly to the sewage system. Residues left in containers can be rinsed down the drain; and the container may be disposed of in the garbage or recycled.

7. Cytotoxic waste and radioactive waste

Cytotoxic waste includes substances with teratogenic, mutagenic or carcinogenic properties. Whereas, radioactive waste include radioactive material and residues of toxic metals (chromium, copper, lead, mercury, nickel, silver and zinc are the most common). [2]

Silver in radiographic fixer solutions

X-ray fixer used routinely in dental clinics to develop x-rays is a hazardous material that should not be easily rinsed in the drain. An in-office silver recovery unit must be used to remove silver from used fixer solutions. Used fixer solution should be sent to a silver reclaiming facility. Use of digital x-ray system and x-ray cleaner without chromium are another suggested safety alternative measures to minimize the radioactive waste. Undeveloped x-ray films have a high level of silver and should be treated as hazardous waste.

Lead foil in intraoral radiograph film packets, lead aprons and lead collars

Excessive doses of lead intake gives rise to neurotoxicity, carcinogenicity, hypertension, impaired renal function, immunology, toxicokinetics and reproductive problems.[12] Lead containing materials must be collected and recycled through a licensed facility.

8. Pharmaceuticals

Pharmaceuticals include anesthetics, sedatives, antibiotics and analgesics. Wastes comprising of outdated, contaminated and discarded medicines should be collected in a yellow colored container.[1]

CONCLUSION

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.

Safe and effective management of biomedical waste is not only a legal necessity but also a social responsibility of dentist, but many of the dentists are not performing the same. Lack of concern, motivation, awareness and cost factor may be some of the reasons for negligence. Necessary measures have to be taken to make sure that biomedical waste is disposed in safe manner.

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