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Biomedical Waste Management-Green Dentistry

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ABSTRACT

Dental Practitioners are becoming increasingly concerned about the potential impact of dentistry on the environment and often take voluntary measures to reduce the production and release of environmentally unfriendly wastes from their practices. So it is important for the dentist to know how to manage and prevent by securing basic knowledge of biohazards components.

Key words: Biomedical waste, color coding, safe disposal, segregation.

INTRODUCTION

Dentistry is a profession dedicated for promoting and enhancing oral health leading to the overall wellbeing of an individual. While accomplishing this, dentists are likely to be exposed to various biological health hazards. This can include medical waste, samples of microorganism, prions, virus or toxin (from biological source) that can impact human health. Waste generated in the process of health care can vary from needles, scalpels, blades, surgical cottons, gloves, bandages, clothes, discarded medicine and body fluids, human tissues and organs, chemicals etc.,

Dental office generates a number of hazardous wastes that can be detrimental both to the dentists and the environment if not properly managed and dental practitioners have been increasingly prone to be exposed to these biohazardous waste materials. So it is important for the dentist to have a basic knowledge biomedical wastes and its disposal.

Bio-Medical Waste Rules (1998)

The Ministry of Environment and Forests notified the "Bio-Medical Waste (management and handling) rules in July 1998. In accordance with these Rules, it is the duty of every "occupier" i.e. a person who has the control over the institution and or its premises, to take all necessary steps to ensure that waste generated is handled without any adverse effect to human health and environment.[1,2]

Biomedical Waste Management Process

Handling, segregation, mutilation, disinfection, storage, transportation and final disposal are the vital steps for safe and scientific management of biomedical waste in any establishment. The key to minimization and effective management of biomedical waste is segregation (separation) and identification of the waste. The most appropriate way of identifying the categories of biomedical waste is by sorting the waste into color coded plastic bags or containers.

Categorization Of Bio-Medical Wastes

Bio-Medical wastes have been categorized into ten different categories as mentioned below :–

Category No.1

Human Anatomical (human tissues, organs, body wastes parts)

Category No.2

Animal Waste (animal tissues, organs,

bleeding parts, fluid, experimental animals used in research, waste generated by veterinary hospitals, discharge from animal houses)

Category No.3

Microbiology & Biotechnology waste (waste from laboratory cultures, stocks or specimens of microorganisms live or attenuated vaccines, human and animal cell culture, waste from production of biological toxins, dishes and devices used for transfer of cultures)

Category No. 4

Sharp Waste (needles, syringes, scalpels, blades, glass. It includes both used and unused sharps).

Category No. 5

Discarded Medicines (waste comprising of outdated contaminated and discarded medicines).

Category No. 6

Solid Waste (items contaminated with blood, and body fluids including cotton, dressings, solid linen, plaster casts, beddings, other material contaminated with blood).

Category No. 7

Solid Waste (wastes generated from disposable items such as tubing's, catheters, intravenous sets etc.).

Category No. 8

Liquid Waste (waste generated from laboratory washing, cleaning, housekeeping and disinfecting activities).

Category No. 9

Incineration Ash (ash from incineration of any bio-medical waste)

Category No.10

Chemical Waste (chemicals used in disinfection etc.)

Steps in Waste Management

Medical waste should be managed according to its type and characteristics. For waste management to be effective, the waste should be managed at every step, from acquisition to disposal. The following are the elements of a comprehensive waste management system:

Waste survey

The survey should differentiate and quantify the waste generated. This helps to determine the method of disposal.

Waste segregation

This consists of placing different kinds of wastes in different containers or color coded bags at the point of generation. It helps to reduce the bulk of infectious waste as well as treatment costs. Segregation also helps to contain the spread of infection and reduces the chances of infecting other health care workers.

Waste accumulation and storage

Waste accumulation and storage occurs between the point of waste generation and site of waste treatment and disposal.

Waste transportation

When medical waste is not treated onsite, the untreated waste must be transported from the generation site to another site for treatment and disposal.

Waste treatment

Treatment is mainly required to disinfect or decontaminate the waste, right at the site of generation so that it is no longer hazardous.

Waste disposal

The waste disposal methods vary in their capabilities, cost, and impacts on the environment. The various disposal methods include incineration, autoclaving, chemical methods, thermal methods (low and high), ionizing radiation process, deep burial and microwaving.

Bio-Dental Waste

Mercury

Although individual dentists generate only small amounts of unfriendly wastes, the accumulated waste produced by the profession may have a significant environmental impact. In recent years the impact of heavy metal contamination of water systems by dentists, particularly through dental amalgam waste is of major concern. Although

dental amalgam is a durable, cost-effective and long-lasting restorative material, it contains mercury, silver and other metals. Mercury is the heavy metal of primary concern, making up to 50% by weight of dental amalgam.[3] Mercury is bioaccumulating and is known to have toxic effects in plants, animals and humans. The placement and removal of dental amalgam restorations generate solid and particulate wastes that can enter the environment, if they are not properly managed. It can allow the mercury in amalgam to be used by bacteria, which are able to convert it to the more toxic organic methyl mercury.[4,5] In bioavailable form, organic mercury can enter the food web, where it tends to accumulate in higher organisms. Although it has not been demonstrated that the mercury in dental amalgam poses a direct threat, the practical approach to waste disposal by dental practitioners is to reduce its potential environmental impact.

During the placement and removal of dental amalgam restorations, a variety of waste products is generated:

- Elemental mercury vapor — released from dental amalgam alloy
- Dental amalgam scrap — the amalgam particles that have not come into contact with the patient (i.e., particles remaining in the dappen dish following restoration placement)
- Amalgam waste — the particles that have come into contact with patient secretions (e.g., particles generated during carving and restoration removal procedures)
- Amalgam sludge — the particles present in dental office wastewater, commonly trapped in chair-side traps and vacuum filters.

Dental Amalgam wastes is also another source of mercury, which is known to be neurotoxic and nephrotoxic. To minimize the amount of mercury vapor emitted from waste amalgam, ADA recommends that it be stored under photographic fixer in a closed container and should be labeled as 'scrap amalgam'.[5]

Currently, it has been estimated that dentists contribute between 3% and 70% of the total mercury load entering wastewater treatment facilities.[5,4] Practitioners are encouraged to follow "best management practices" in the handling and disposal of dental amalgam to limit its potential environmental effects. It is advised to use precapsulated dental amalgam to reduce the risk of liquid mercury spill. Alternative restorative materials (i.e., composite resin, ceramic or other metal alloys) can be used, when indicated. Limiting the amount of dental amalgam triturated for a procedure also reduces the amount of waste generated. Dentists are legally responsible for the collection, storage and disposal of both gross debris and amalgam particles removed via high-volume suction. At present, many dental offices have chair-side filtration devices, as well as secondary filters to protect vacuum pumps. These devices trap larger particles of dental amalgam. Chair-side traps have been found to be approximately 68% effective in their removal of amalgam particles from dental wastewater, while the average vacuum filter is approximately 40% effective. A number of certified amalgam separators are able to reduce amalgam particles in dental wastewater. These devices separate the fine particles (generated during restoration finishing, polishing and removal procedures) from wastewater, thereby limiting the amount sent to wastewater management facilities. Once collected, mercury and dental amalgam waste should be handled in the same manner as all hazardous waste; staff members should be properly trained and should use gloves, masks, gowns and protective eyewear when disposing amalgam waste. Dental amalgam scrap as well as amalgam waste gathered by filters and separation devices should be collected periodically and stored in a labeled, leak-proof container. The proper storage of dental amalgam will also reduce the amount of elemental mercury vapor that enters the work environment. Regardless of the means of disposal of dental amalgam, practitioners should not flush contaminated wastewater down sinks, rinse chair-side traps or vacuum filters in sinks, nor place material containing dental amalgam in general garbage or waste to be incinerated. These practices release mercury into the environment and negate the profession's efforts to reduce environmental mercury contamination.

Silver

Silver is another heavy metal that can enter our water system via improper disposal of dental office waste. Some forms of silver are more toxic

than others; for example, silver thiosulfate in radiographic fixer is less toxic than free silver ions. Again, limits for silver concentration in wastewater are set by individual municipalities and jurisdictions and can be obtained through local environment authorities.[6] Alternatively, a certified waste carrier can be contacted to dispose of the waste by recycling. With recent advances in radiographic technology, digital imaging is becoming a popular means of obtaining dental radiographs. Therefore, incorporation of digital imaging within the dental office can greatly reduce the amount of silver waste generated, absence of chemical processing and reduced radiation exposure.

Lead

An additional byproduct of traditional radiography is the lead shields contained in each film packet. Although the lead shields themselves are relatively small, the cumulative waste produced can be considerable. An added benefit of digital radiography is the reduction in lead waste production. Lead, like mercury and silver, is toxic and persists in the environment. Even at low levels of exposure, lead exerts adverse health effects.[7,6] Reducing environmental lead contamination by dental practitioners is inexpensive and easy task. The lead shields from film packets merely have to be collected and returned periodically to the manufacturer for recycling. But report states that only about 5% of products sold are returned and it is due to lack of awareness of the offered service.[8,9]

X-ray fixer solution

As stated before, the silver content in the fixer solution is hazardous. In the environment, free ionic silver acts as an enzyme inhibitor by interfering with the metabolic processes of organisms. These have to be disposed off as a hazardous waste or sent to a silver recovery system.

X-ray cleaner solution

Many cleaners for X-ray developer system contain chromium. If the cleaner solution used contains chromium, it should be disposed as a hazardous waste or switch to a non-chrome cleaner.

Points to remember for Waste Management in the Hospital:

1. Segregate waste at the point of generation.
2. Collect waste in color coded containers/bags.
3. Decontaminate all sharps and plastic waste by chemical method/autoclave.
4. Shred the plastic waste.
5. Use syringe and needle destroyer.
6. Incinerate blood soaked dressings/body parts etc.
7. Cover waste collection containers.
8. Transport through covered trolleys/wheel barrows.
9. Provide protective wear (mask, gloves, plastic aprons, gum boots to transporters and handlers).
10. Immunize all waste handlers.

CONCLUSION

Dental practitioners are becoming increasingly concerned about the potential impact of dentistry on the environment and often take voluntary measures to reduce the production and release of unfriendly wastes from their practices. As health practitioners, we should be concerned with promoting not only human health and well-being but also that of the environment. It is not only our legal obligation to provide dental services but also our moral and ethical obligation for safe and effective management of waste. Lack of concern, motivation, awareness and cost factor are some of the problems faced in proper hospital waste management. Thus proactive approach will allow our profession to succeed in an era of increased public environmental concern and protective legislation.

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