International Dental Journal of Student's Research 2021;9(2):68–72

Content available at: https://www.ipinnovative.com/open-access-journals

International Dental Journal of Student's Research

Journal homepage: https://www.idjsr.com/

Review Article

Biomedical waste management in dental office

Taniya Malhotra[1], Vrinda Vats[2], Lokesh Yadav[3], Akshat Sachdeva[2,*]

[1]*Dept. of Prosthodontics and Crown & Bridge, SGT Dental College and Hospital, Gurugram, Haryana, India*
[2]*Dept. of Conservative Dentistry and Endodontics, Sudha Rustagi College of Dental Sciences and Research, Faridabad, Haryana, India*
[3]*Dept. of Oral and Maxillofacial Surgery, SGT Dental College and Hospital, Gurugram, Haryana, India*

ARTICLE INFO

Article history:
Received 24-05-2021
Accepted 12-07-2021
Available online 03-08-2021

Keywords:
Biomedical waste
Management
Dental office
Disposal

ABSTRACT

Biomedical waste (BMW) is one of the notable etiologic factors for Hospital Acquired Infection, and is one of the major ecological challenges of today's world. A lot of biomedical waste is generated in the dental office, whether in teaching institutions or private practice, which if not managed properly, can be hazardous to dental professionals, dental auxiliaries, patients and other health care service providers who work in the dental office. The present review discusses some common waste products produced by dental offices, the hazards of indiscriminate disposal and different plans of action for handling of BMW.

1. Introduction

Biomedical waste can be elucidated as any waste generated throughout diagnosis, treatment or immunization of humans or animals, or in research works pertaining thereto, or in the production or testing.[1] This incorporates waste products like plastic, latex, glass, metallic foils, sharps, cotton, gauze, extracted teeth and delicate tissues, and dental substances which can be contaminated with body fluids.[1] Generated waste can be potentially hazardous and may be a serious threat to human wellbeing if waste handling is indiscriminate. Proper control of dental waste is undoubtedly an important aspect of environmental health safety and must become an integral part of dental services with prevention and minimization of waste being the most practical solution.

2. History

It is reported that the issue of BMW was first discussed at an assembly convened via the World Health Organization regional office for Europe at Bergen, Norway in 1983. The earnestness of this issue was highlighted all through the "beach wash- ups" of summer 1988. Investigations performed by the Environment Protection Agency (EPA) of USA culminated in the passing of Medical Waste Tracking Act (MWTA), November 1988. Over the years, the problem has taken rounds to be known as a worldwide humanitarian concern.[2]

In our country, this matter has attracted the heed of the Honorable Supreme Court of India and certain recommendations have been issued. The Bio-medical waste (Management and Handling) Rules 1998 lay down modus operandi for scrapping of BMW. Pollution control boards of each state have been given the responsibility of authorizing and imposing the regulations.[2]

3. Categories of Biomedical Waste

There are a total of ten categories mentioned in The Government of India, "Biomedical Waste (Management and Handling) rules" 1998, which have been listed in Table 1 along with their treatment and disposal methods.[3]

* *Corresponding author*.
E-mail address: akshat16.sachdeva@gmail.com (A. Sachdeva).

https://doi.org/10.18231/j.idjsr.2021.013

Table 1: Categories of biomedical waste, their segregation and disposal

Option	Waste Category	Treatment & Disposal
Category 1	Human anatomical waste (human tissues, organs, body parts)	Incineration*/deep burial†
Category 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 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 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 5	Discarded medicines and cytotoxic drugs (wastes comprising of outdated, contaminated and discarded medicines)	Incineration*/destruction and drugs disposal in secured landfills
Category 6	Solid waste-Items contaminated with blood and body fluids including cotton, dressings, plaster casts, linen, beddings, etc.	Incineration*/autoclaving/microwaving
Category 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 8	Liquid waste (waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)	Disinfection by chemical treatment‡and discharge into drains
Category 9	Incineration ash (ash from incineration of any biomedical waste)	Disposal in municipal landfill
Category 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 pretreatment 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

Biomedical waste generated in dental office can be classified as:[4]

1. Dental amalgam wastes
   (a) Amalgam traps
   (b) Bulk Mercury
   (c) Contact Amalgam (extracted teeth with amalgam restorations)s
2. Other scrap heavy metals such as lead foils
3. X-Ray processing wastes
   (a) Silver-Containing Wastes (X-Ray fixer solution)r
   (b) X-Ray Photographic Developerm
   (c) X-Ray System Cleaners Containing Chromiums
4. Chemicals, dsinfectants and sterilizing agents
5. Medical waste
   (a) Sharps
   (b) Bio-hazardous waste
6. Non hazardous waste

These waste materials can lead to various perils encompassing health and occupational hazards, environmental hazards such as water, air and soil pollution, along with social, economic and political problems. Dental waste also can prove to be critical owing to the presence of dangerous, toxic as well as pathogenic agents, comprising pathological, chemical, pharmaceutical, radioactive, infectious and sharp and cutting waste.

4. Hazards of Dental Waste

As BMW produced in the dental practice consists of infectious agents, toxic chemicals or pharmaceuticals and sharps, it is all the more risky for people who are exposed to the same. There are health risks to populations, i.e. dentists, dental auxiliaries, patients, waste handling and treatment workers, and overall population as a whole.

Pathogens present in infectious waste can enter the body through a puncture or cut in the skin, with the aid of inhalation or ingestion via mucous membranes. There is a concern about Human Immunodeficiency Virus as well as Hepatitis Virus, for which a robust evidence of

transmission via healthcare waste is available. Bacteria that are resistant to antibiotics and disinfectants may also play their part towards hazards created by inappropriately managed waste.[3]

A good deal of chemical substances is toxic, genotoxic, corrosive, flammable, reactive, explosive or shock sensitive. They may lead to intoxication even in smaller quantities, due to both acute or chronic exposure and injuries, including burns. Disinfectants are utilized in great numbers and can be corrosive. Reactive chemicals may perhaps lead to the formation of highly toxic secondary compounds.[3]

Radioactive waste is genotoxic and thus may affect genetic material. The effects of exposure range from headache, dizziness, and vomiting to even malignancies.[3]

Besides health hazards, the overall population is very thoughtful of the visual impression of health-care waste. There can be esthetic degradation of the surroundings from the careless disposal. There can be several adverse environmental impacts from inappropriate handling of waste. It may lead to changes in microbial ecology and microbial resistance to several anti-microbial agents. If waste accumulates, it can be a potential health hazard. The reason is that it decomposes and facilitates fly breeding, draws attention of rodents, which when present in the waste may be transported back to man's meals through flies and dust. There is also a likelihood of water and soil pollution and heaps of waste represents an unsightly appearance and nuisance that occurs from bad odor.[3]

5. Biomedical Waste of Concern in Dental Office

Dental waste constitutes a subdivision of hazardous BMW. With an increase in the burden of oral health and the expansion of dental practice, dentistry has made a huge contribution to the production of hazardous BMW in the form of lead foil in X-ray film, chemicals, and dental mercury etc.[5] The most common BMW materials of dental concern include:

5.1. Mercury (Hg)

It has been several years in the dental profession that mercury as amalgam is being employed as a dental filling material. Mercury is known to be a toxic and bioaccumulative metal. Mercury usually exists in nature in the form of sulfide and various minerals. It is present in elemental, inorganic and organic forms. The dental industry uses approximately 6% of the total annual domestic consumption of mercury, which is estimated to contribute significantly to mercury emissions to wastewater streams (14% in one study). It is also known that mercury has toxic effects on plants, animals and humans.[6]

5.2. Silver

Silver is another heavy metal that can set foot in our water system through improper disposal of dental office waste. The radiographic fixer solution used (commonly used in dental radiograph processing) contains silver. The concentration of silver in the used fixing agent solution is usually 8 to 12 g/L. Another common source of waste in dental clinics is unused films which should not be placed in ordinary garbage. Unused film contains unreacted silver, which may be toxic to the environment.[6]

5.3. Lead

Another by-product of traditional radiography is the protective lead layer contained in each film packet. Although the lead shield itself is small, the accumulated waste generated can be large. Lead is a harmful metal and, if it is thrown away and sent to landfills, it can contaminate soil and groundwater.[6]

6. Management of Dental Waste

Medical waste must be managed according to its type and characteristics. For waste management to be effective, waste must be managed at every step, from acquisition to disposal.[7] The waste sorting system can ensure that the waste is processed according to the hazard of the waste, and that the correct method of disposal is adopted and the correct transportation equipment is used.

The National Accreditation Board for Hospitals and Healthcare Providers (NABH) recommends certain principles for waste management which are as under:[8]

Develop a waste management plan, which is based on an assessment of the current situation and minimizes the amount of waste generated.

1. Separate clinical (infectious) waste from non-clinical waste in a special container.
2. Use special carts for transportation of waste.
3. Store waste in specific areas with restricted access.
4. Sharps should be collected and stored in a sharps container. The sharps container should be made of plastic or metal and have a closable lid. Mark storage areas with biohazard sign.
5. Make sure that trolleys or carts used for the transport of separate waste collection are not used for any other purpose: they must be cleaned regularly.
6. Determine the storage area of the waste before disposal or before sending it to the final disposal area.

As per the updated color coding for Biomedical Waste Management (2016), waste should be disposed off in respective color bags as listed below:[9]

6.1. Yellow: Collected in yellow non – chlorinated plastic bags or containers

1. Human anatomical waste: Human tissues, body parts and organs.
2. Soiled waste: Blood defiled items, plaster casts, cotton swabs, bag with remaining or discarded blood.
3. Expired as well as discarded medications: Pharmaceutical waste comprising of ampules along with vials.
4. Chemical liquid waste: X-ray developing liquid, disposed formalin, contaminated secretions, aspirated fluids, liquid released from laboratories and floor washings.
5. Microbiology, Biotechnology & laboratory waste: Culture media, specimens of microorganisms, live/attenuated vaccines.

6.2. Red: Collected in red colored non-chlorinated plastic bags or containers

1. Contaminated waste caused by the use and release of objects (such as tubes, bottles, intravenous tubes, catheters, urine bags, syringes, etc.).

6.3. White: Accumulated in puncture-proof, leak-proof and tamper-proof containers

1. Needles, syringes with fixed needles, needles from tip cutter, scalpels, blades, or other infected needle-like article.

6.4. Blue: Collected in cardboard boxes with blue colored markings

1. Glassware: Broken/discarded along with adulterated glass items incorporating medicine vials and ampules except those contaminated with cytotoxic wastes.
2. Metallic body implants.

6.5. Disposal of mercury containing waste

Management of waste containing vaporous mercury includes:[10]

1. Storage of unused mercury in leak-proof containers.
2. Communication with a certified biomedical waste carrier (CWC) with regard to disposal and recycling..
3. Use a "mercury spill kit" in case of a spillage incident.
4. Not disposing off elemental mercury in the garbage.
5. Avoid washing elemental mercury in the drain.
6. Using disposable amalgam separators on dental suction devices in order to prevent amalgam accumulation.
7. Required amalgam amount only mixed or use premeasured amalgam capsules.
8. Use mercury containers to store all scrap/old amalgam.

6.6. Disposal of sharps

Sharp objects are considered highly hazardous medical waste because they can cause injuries and stab wounds. Due to exposure to contaminated sharp objects, there is always a risk of transmission of blood-borne pathogens (such as HIV, Hepatitis B, and Hepatitis C).

The needle should be destroyed with a needle destroyer or a syringe melting and disposing system. Crushed sharp tools should be placed in a puncture-proof sharps container, which should contain 1% NaOCl for disinfection. After the container is three-quarters full, it must be sent to the common treatment facility for shredding, packaging, and disposal in a landfill.[11]

7. Green Dentistry

Green or Eco-friendly dentistry is an upcoming and emerging trend in the dental profession. It aims at diminishing the overall environmental impact of dental practice in shifting towards an ecologically sustainable health care system by incorporating a high-tech perspective.Reducing the generation of BMW in the dental office is one of the components of green dentistry. Green dentistry is a whole - earth initiative to tooth care that lessens the pessimistic environmental viewpoint of dentistry and builds a caring environment for humans. It is based on the model of four R's – Rethink, Reduce, Reuse and Recycle.[9]

8. Conclusion

As healthcare practitioners, we as dentists should be concerned about promoting not just human health along with well-being, but also that of the environment. Biomedical Waste management programs cannot be a success in the absence of the required devotion, self-motivation, willingness, cooperation and participation of all the employees of health care sectors. Dental practitioners need to be educated via educational programs regarding the correct waste disposal methods to improve their practical abilities in the dental office. A holistic approach will definitely help our profession to triumph in today's world of increased public environmental concern and protective litigation.

9. Source of Funding

None.

10. Conflict of Interest

The authors declare that there is no conflict of interest.

References

1. Kulkarni SS, Sushanth VH, Prashant GM, Imranulla M, Vivek HP, Costa FD. Current knowledge, attitude and practices of dental residents towards biomedical waste management: A cross sectional study. *J Glob Oral Health*. 2019;2(1):23–8. doi:10.25259/jgoh_31_2019.
2. Available from: https://www.ida.org.in/Membership/Details/History.
3. Baghele ON, Baghele MO, Deshpande AA, Deshpande JP, Phadke S. A simplified model for biomedical waste management in dental practices - A pilot project at Thane, India. *Eur J Gen Dent*. 2013;2(3):235–40. doi:10.4103/2278-9626.115992.
4. Available from: https://www.ida.org.in/Membership/Details/BiomedicalWasteManagementProtocol.
5. Jamkhande A, Bulani M, Hiremutt D, Godbole A, Rawlani D, Bhadani H, et al. Attitude, and Practice about Dental Waste Management Among Dentists in Pune - A Questionnaire Study. *Int J Sci Stud*. 2019;6(11):6–12.
6. Muhamedagic B, Muhamedagic L, Masic I. Dental Office Waste - Public Health and Ecological Risk. *Mat Soc Med*. 2009;21:35–8. doi:10.5455/aim.2009.21.35-39.
7. Hegde V, Kulkarni RD, Ajantha GS. Biomedical waste management. *J Oral Maxillofac Pathol*. 2007;11(1):5–9. doi:10.4103/0973-029x.33955.
8. Available from: https://www.nabh.co/Images/PDF/HIC_Guidebook.pdf.
9. Sachdeva A, Sharma A, Bhateja S, Arora G. Green Dentistry: A Review. *J Dent Oral Biol*. 2018;3(6):1144.
10. Dhanya RS, Betur AP, Bulusu A, Adarsh VJ, Koshy PV, Pinto B. Management of Biomedical Waste in Dental Clinics. *Int J Oral Care Res*. 2016;4(4):288–90. doi:10.5005/jp-journals-10051-0065.
11. Bathala LR, Jupidi B, Thota MM, Theruru K, Shaik S, Rayapati S. "There′s plenty of room at the bottom": The biomedical waste management in dentistry. *J Dr NTR Univ Health Sci*. 2014;3(3):149–55. doi:10.4103/2277-8632.140931.

Author biography

Taniya Malhotra, Post Graduate

Vrinda Vats, Post Graduate

Lokesh Yadav, Post Graduate

Akshat Sachdeva, Post Graduate

Cite this article: Malhotra T, Vats V, Yadav L, Sachdeva A. Biomedical waste management in dental office. *International Dental Journal of Student's Research* 2021;9(2):68-72.