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How to Dispose Biomedical Waste In Orthodontic Practice: A Review

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ABSTRACT

Proper management of biomedical waste produced in Orthodontic practice is an important component of environmental health protection. Wise handling and disposing of biomedical waste is very critical. In Orthodontic practice, a number of biomedical wastes are produced. This article is designed to explore and review on the issues such as categories related to biomedical waste and procedures of handling and disposal methods of biomedical waste management in Orthodontic practice and formulate a simplified scheme.

Key words

Biomedical waste; management; Orthodontics; practice; schedule; segregation.

INTRODUCTION

TWastes can be categorized as municipal waste, clinical or biomedical waste, electronic waste, industrial waste, agricultural waste etc. In this article, we will focus on biomedical waste. Biomedical waste (BMW) has been defined as "any waste that is generated during the diagnosis, treatment, or immunization of human beings or animals, or in the research activities pertaining to or in the production or testing of biological or in health camps and also includes categories mentioned in the Schedule I of the Biomedical Waste (Management and Handling) rules 1998."[1,2] With the notification of the Biomedical Waste rules, the hospitals have started proper waste management by disposal of their waste in an eco-friendly and responsible manner. Improper waste management can lead to change in microbial ecology and may be antibiotic resistance.[3] The best disposal options are prevention of release of toxic substances from dental clinics to the environment.[4]

India is likely to generate about 775.5 tons of medical waste per day by 2022 from the current level of 550.9 tons per day growing at compound annual growth rate (CAGR) of about 7%.[5] Total quantity of waste generated from dental clinics is about 0.161 kg/clinic/day with 0.130 kg and 0.026 kg of infectious and recyclables, respectively.[6] Dental waste is a subset of hazardous biomedical waste. It is generated during various procedures and includes cotton, latex, syringe, glass, sharps, human body parts, and fluids (such as blood), dental materials and chemicals.[7]

In a new ruling released by the government on March 27, 2016, the segregation and treatment methods of biomedical waste were amended.[4]

Regulations related to Biomedical waste management-

It is the obligation of the owner of the dental clinic to segregate the orthodontic waste in appropriate category. In case of a visiting orthodontist, the duty falls on the orthodontist to guide the dentist about proper segregation and disposal.

The Bio-Medical Waste Management Rules, 2016 includes:

- Schedules – I to IV
- Forms –I to V

- Form I - Accident reporting
- Form II - Application for authorization or renewal of authorization [To be submitted by occupier of health care facility (HCF) or common bio-medical waste treatment facility (CBMWTF)]
- Form III - Authorization (Authorization for operating a facility for generation, collection, reception, treatment, storage, transport and disposal of biomedical wastes)
- Form IV - Annual report [To be submitted to the prescribed authority on or before 30th June every year for the period from January to December of the preceding year, by the occupier of health care facility or common bio-medical waste treatment facility]

- Form V - Application for filing appeal against order passed by the prescribed authority.

- Rules - 1 to 18

Any violation of the provisions of the said rules attracts action under the environment (protection) act,1986, as amended to date, wherein there is provision for punishment of imprisonment for a term which may extend to five years with fine upto one

TABLE I: SCHEDULE 1- Biomedical wastes categories and their segregation, collection, treatment, processing and disposal options.[9]

Categories	Types Of Waste	Type Of Bag And Container	Disposal Option And Processing
Yellow	Human Anatomical Waste: Human tissues, organs, body parts like extracted teeth, bone fragments etc.	Yellow colored non-chlorinated plastic bags	Incineration or Plasma Pyrolysis or deep burial.
	Soiled Waste: Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood and blood components.		Incineration or Plasma Pyrolysis or deep burial. In absence of above facilities, autoclaving or micro- waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery.
	Expired or Discarded Medicines: Pharmaceutical waste like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc.	Yellow coloured non-chlorinated plastic bags or containers	Expired `cytotoxic drugs to be returned back to the manufacturer or supplier for incineration at temperature >1200^{0}C or to common bio-medical waste treatment facility or hazardous waste treatment, storage and disposal facility for incineration at >1200^{0}C. All other discarded medicines shall be either sent back to manufacturer or disposed by incineration.
	Chemical Liquid Waste: Liquid waste generated due to use of chemicals in production of biological and used or discarded disinfectants, etchants, Silver X-ray film developing liquid, discarded Formalin, infected secretions, aspirated body fluids, liquid from laboratories and floor washings.	Separate collection system leading to effluent treatment system	After resource recovery, the chemical liquid waste shall be pre- treated before mixing with another wastewater. The combined discharge shall conform to the discharge norms given in Schedule-III.
	Chemical Waste: Chemicals used in production of biological and used or discarded disinfectants	Yellow colored containers or non-chlorinated plastic bags	Disposed of by incineration or Plasma Pyrolysis or Encapsulation in hazardous waste treatment, storage and disposal facility
	Discarded linen, mattresses, beddings contaminated with blood or body fluid, Routine mask and gown.[11]	Non-chlorinated yellow plastic bags or suitable packing material	Non- chlorinated chemical disinfection followed by incineration or Plazma Pyrolysis or for energy recovery. In absence of above facilities, shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery or incineration or Plazma Pyrolysis.
Red	Contaminated Waste (Recyclable) (a) Wastes generated from disposable items such as tubing, syringes (without needles and fixed needle syringes) aligners, retainer boxes and vaccutainers with their needles cut) and gloves	Red colored non-chlorinated plastic bags or containers	Autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent to registered or authorized recyclers or for energy recovery or plastics to diesel or fuel oil or for road making, whichever is possible. Plastic waste should not be sent to landfill sites.
White	Waste sharps including Metals: Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, brackets, archwires, metal ligature ties,bands, removable or fixed appliances like class 2 corrector appliances or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded and contaminated metal	Puncture proof, Leak proof, Tamper proof containers	Autoclaving or Dry Heat Sterilization followed by shredding or mutilation or encapsulation in metal container or cement concrete; combination of shredding cum autoclaving; and sent for final disposal to iron foundries (having consent to operate from the State Pollution Control Boards or Pollution Control Committees) or sanitary landfill or designated concrete waste sharp pit.
Blue	a) Glassware: Broken or discarded and contaminated glass including medicine vials and ampules except those contaminated with cytotoxic wastes b) Metallic body implants such as micro implants and mini plates	Puncture proof and leak proof boxes or containers with blue colored marking.[11]	Disinfection (by soaking the washed glass waste after cleaning with detergent and Sodium Hypochlorite treatment) or through autoclaving or microwaving or hydroclaving and then sent for recycling

lakh rupees, or with both.[8]

Table II: Orthodontic waste disposal protocol[12]	
Orthodontic Materials	*Criteria for waste disposal*
Impression Material (Discarded/Used)	**Immerse in 1% Sodium hypochlorite solution[11] and dispose as general waste**
Dental Casts (Discarded/Used)	**Immerse in 1% Sodium hypochlorite solution[11] and dispose as general waste**
Wires, steel ligatures, burs, blade, needle after being burnt	**White sharp container**
Metallic brackets, bands, buttons and other attachments	**White sharp container**
Plastic and Ceramic brackets	**Red Bag**
Removable appliances with wire component like expansion appliances (Used/broken not to be worn by patient anymore)	**White sharp container**
Orthodontic mini-implant, vials, ampules	**Blue container**
Wax bite registration	**Red Bag**
E-chain, elastic ligatures, elastics	**Red Bag**
Surgical and examination gloves	**Red Bag**
Blood or saliva contaminated cotton, gauze, linen, paper, sutures	**Yellow Bag**
Face masks, gowns[11]	**Yellow Bag**
Syringe after breaking hub in needle destroyer	**Red Bag**
Extracted teeth and tissues	**Yellow Bag**
Discarded and unused medicines[9]	**Yellow Bag**
Plastic suction tips, eye shield	**Red Bag**
Aligners	**Red Bag**
Primer bottle, composite syringe	**Red Bag**

SCHEDULE[9]

1. Schedule I: Biomedical wastes categories and their segregation, collection, treatment, processing and disposal options. (Table 1)
2. Schedule II: Standards for treatment and disposal of bio-medical wastes
3. Schedule III: List of Prescribed Authorities and the Corresponding Duties
4. Schedule IV
   a) Part A: label for bio-medical waste containers or bags. (Figure 1, 2)
   b) Part B: label for transporting bio-medical waste bags or containers. (Figure 3)

Management of wastes in Orthodontic practice

Refer to Table II

Segregation at source:

Segregation means the separation of different categories of waste generated at source and thus minimizing the risks and cost of handling and disposal. This first step is considered the most crucial step. Efficient segregation ensures proper bio-medical waste management in orthodontic practice. The biomedical waste should be collected in containers/ bags in such a way that it does not overflow.[4]

Advantages of Segregation:

- Prevents the mixture of medical waste like sharps with the general municipal waste.
- Stops illegal reuse of certain components of medical waste like used syringes, needles and other plastics.
- Aids in recycling certain components of medical waste like plastics.

Pre-Treatment:

After segregation and collection, waste needs to be pre-treated by the owner of the clinic as mentioned in table I.

Proper labelling of containers/ bags:

In accordance to the new rules clear labelling of the biohazard or cytotoxic waste with help of symbol on containers and bags must be done.

Storage

Once the above steps have been completed, then biomedical waste is stored in a proper place for transportation. Caution sign should be placed on the storage area.

Fig. 1 Cytotoxic label for bio-medical containers or bags

Fig. 2 Biohazard label for bio-medical waste container or bags

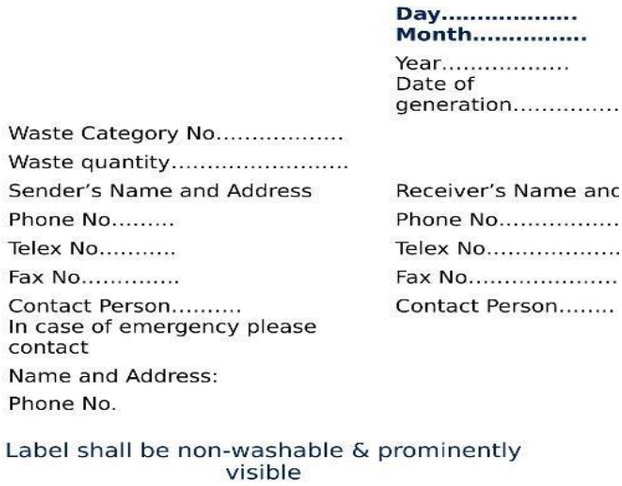

Fig. 3 Label for transporting bio-medical waste containers or bags.

Transportation

Before transportation, the Container /bags containing BMW should be tied/ lidded and labels for each bag/container should also be clearly placed. Covered wheel barrows or trolleys should be used for transportation of waste. Manual loading of waste should be avoided. Transportation is done in special vehicles to prevent direct contact of waste by the transportation worker, the scavengers and the public.[4]

Treatment, Disposal and Processing

Every healthcare facility/clinic generates BMW. It is thus required that the establishment must set up waste treatment modalities such as autoclave and microwave system or make sure that the requisite treatment of waste occurs at a CBMWTF. In case a CBMWTF service is available within 75 km, treatment and disposal facility must not be established by any occupier at the healthcare facility.

According to BMW management rules 2016, only non-chlorinated plastic bags, gloves and blood bags should be used. The carry bags used in BMW are to be treated as per the Plastic Waste Management Rules, 2011. Before the healthcare workers and others involved in handling of BMW can start their jobs they must be trained before and the training should be repeated at least once every year. Immunization like hepatitis B and tetanus should be provided for free to all healthcare workers and those involved in handling of BMW for protection against diseases. Major accidents caused such as blasts occurring while handling BMW etc. and the remedial actions taken must be reported to State Pollution Control Board.

Personnel safety devices

Heavy-duty rubber gloves, face masks, goggles, head cap, aprons and boots etc. should be used to prevent contamination of worker's cloth and skin by bio hazardous or infected waste.

CONCLUSION

Orthodontists should make themselves aware regarding the proper biomedical waste management in order to reduce the hazardous effect caused by BMW not only to environment but to themselves, dental

Conflict of interest & source of funding

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Abbreviations used:

1. BMW – Biomedical Waste
2. HCF – Healthcare Facility
3. CBMWTF - Common Biomedical Waste Treatment Facility

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