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DENTAL BIOMEDICAL WASTE MANAGEMENT

Rajeev Sharma[1], Sanjeev Kumar[1], Nitika[2]

[1]Post Graduate Department of Chemistry, Multani Mal Modi College, Patiala Punjab

[2]Govt. Adarsh Senior Secondary School, Canal Colony, Bathinda Punjab

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Corresponding Author:

E-Mail: sharmarajeev0379@gmail.com

ABSTRACT

Hospitals are the health care institutions which have existed since time immemorial in one form or another and have become more complex with time because more health problems and advances in treatment technology. The general public now a day is more conscious regarding oral health and as a result there is significant increase in the dental hospitals, clinics and dental teaching institutes and correspondingly there is tremendous increase in the amount of biomedical waste generated by the dental hospitals, clinics and dental teaching institutes. The biomedical waste generated in dentistry has recently emerged as an issue of major concern not only to hospitals and clinics and other establishments but also to environmentalists and general public.

In this paper an attempt has been made to review the waste generated in the dentistry. The emphasis has been laid to throw a light on the effect of this waste on environment and human health to create awareness among dental professionals and general public regarding its management and disposal

Keyword: Biomedical Waste, Hospitals, Waste Category Segregation, Mercury, Waste Management.

INTRODUCTION

Biomedical waste may be defined as "Any solid, fluid or liquid waste, including its container and any intermediate product, which is generated during the diagnosis, treatment or immunization of human beings and or animals, in research pertaining thereto, or in the testing of biological and animal waste from slaughter houses or any other like establishments (Biomedical waste riles 1998 of India) (Aggarwal et al., 2011).

The biomedical waste management and handling rules have been notified in 1998.The rules were amended in 2000, primarily to address administrative matters.With the notification and amendments of the biomedical wastes (BMW) rules, hospital waste management has been brought into focus in India. According to the rules it is mandatory for the healthcare establishments to segregate, disinfect and dispose their waste in an

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ecofriendly manner (Sharma, 2010).Biomedical waste is mainly classified as biological and non biological waste, some waste may be infectious and some may be non infectious (Thirumala, 2013).This waste is potentially hazardous, the main hazard being infection and the poor management practices pose a threat to environment and the health of the public patients and professionals (Umar and Yaro, 2009).

Hospitals are the health care institutions which have existed since time immemorial in one foror the other and have become more complex because of more health problems and advances in treatment technology in the present time frequented by people from every walk of life without any distinction between sex, age, caste, creed and religion (WHO, 1980).

Now a days, people have become more conscious of their oral health. As a result there is a significant increase in the dental hospitals, dental clinics, medical teaching and general hospitals and correspondingly there has been tremendous increase in amount biomedical waste generated by dental hospitals and clinics. Waste generated in dental hospitals is similar to that generated by other hospitals which includea large component of general waste and a similar proportion of hazardous waste (Singh et al., 2012).Biomedical waste generated in dental clinics include sharps such as needles, body tissues that include extracted teeth, chemical fixers, lead foils, silver thiosulphate, mercury, fresh mix of amalgam, scarp amalgam etc., and other used dental materials (Rudraswamy et al., 2012). Dental professionals are at a greater risk for acquiring cross infection while treating patients as is evident from the fact that most of the pathogens have been isolated from the oral secretions (Singh et al., 2012). Dentists use instruments and materials that are directly exposed to blood and saliva and are thus potential source of infection. Many chemicals like acrylics, impression materials and mercury used for restorative purposes may have a possible environmental and human health impact if not handled properly (Mehta et al., 2013; Pandit et al., 2005).This improperly disposed hazardous waste enters the food chain either via water or soil and can show harmful effects in animals and humans. Most chemical waste streams accumulate large amounts of such waste which in turn get accumulate in the flora and fauna inhabiting these streams and cause health hazard in food chains when these creatures are consumed by other organisms. There are several ways that mercury from dental amalgam can enter into environment. Dental amalgam particles are known to be neurotoxic and nephrotoxic.Fetuses and newborn babies are more sensitive to mercury than adults (Aggarwal et al., 2011). Medical waste poses high risk to doctors, nurses, technicians, sweepers, hospital visitors and patients due to arbitrary management.

Many surveys have been published on the biomedical waste management in India on private and general dental practices (Sudhakar and Chandreshekhar, 2008; Singh et al., 2012; Khandelwal et al., 2013)and on dental teaching institutions (Kapoor et al., 2014;Thota et al., 2015). If the infectious component gets mixed with the general non-infectious waste, the entire mass becomes potentially infectious (Patil and Pokheral, 2005).However usually, in dental hospitals the general mix due to negligence and lack

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of attention clearly proves that general waste generated in dental hospitals and clinics is also toxic and hazardous to the mankind and environment.

In this paper an attempt is being made to highlight the management strategies which must be adopted in dental hospitals and clinics for the waste generated there and to spread the awareness among dentists, dental auxiliaries, attenders and general public regarding biomedical waste generated in dental hospitals and clinics and its management.

Appropriate management of dental care waste is a crucial component of environmental health protection and it should become integral feature of dental services. The handling of biomedical waste is mentioned in Schedule II (Table 1) of the biomedical waste, management and handling rules (1998) rules.

Table1: Categories of biomedical waste, their segregation and disposal

Schedule 1: Categories of biomedical waste(Baghele et al., 2015).

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, college, discharge from hospitals, animal houses)	Incineration*/deep burial†
Category no.3	Microbiology and biotechnology waste (waste from laboratory cultures, stocks or specimens of microorganisms, live or attenuated vaccines, human and animal cell cultureand infectious agents from research and industrial laboratories, wastes from production of biological, 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 (waste comprising of outdated, contaminated and discarded medicines)	Incineration*/destruction and drugs disposal in secured landfills
Category	Solid wastes itemscontaminated with	Incineration*/autoclaving/mi

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no.6	bloodand body fluids including cotton, dressings, plaster casts, linen, beddings etc.	crowaving
Category no. 7	Solid wastes (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 wastes (chemical used in production of biological, chemicals used in disinfection as insecticides etc.)	Chemical treatment and discharge into drainsfor liquids and secured landfill for solids

*There will be no chemical pretreatment before incineration; chlorinated plastic 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 insured that chemical treatment ensures disinfection; Mutilation/shredding must be such so as to prevent unauthorized reuse.

Schedule II: Color coding and type of container for disposal of biomedical wastes(Baghele et al., 2015).

Color coding	**Type of container**	**Waste category**	**Treatment options as per schedule 1**
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

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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 1; 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.

HEALTH HAZARDS OF DENTAL CARE WASTE

Because the BMW contains infectious agents, toxic or hazardous chemicalsor pharmaceuticals, sharps and it may be genotoxic or radioactive; it is potentially risky for persons who are exposed to it. There are health risks to several different and overlapping populations, e.g. health care employees, dentists, patients, waste handling and treatment workers and the generalpopulations.

1.**Hazards from infectious wastes and sharps** (Park, 2002)**:** Pathogens in infectious waste may enter the human body through a puncture, abrasion or cut in the skin, through mucous membranes by inhalation or by ingestion. There is a particular concern about infection with human immunodeficiency virus and hepatitis B and C, for which there is strong evidencethere is strong evidence of transmission via health care waste. Bacteria resistant to antibiotics and chemical disinfectants may also contribute to the hazards created by poorly managed waste.

2.Hazards from chemical and pharmaceutical waste (Park, 2002)**:**Many of the chemicals are toxic, genotoxic, corrosive, flammable, reactive, explosive or shock sensitive. Although present in small quantity they may cause intoxication, either by acute or chronic exposure and injuries, including burns. Disinfections are particularly important. They are used in large quantities and are often corrosive and reactive chemicals may form highly toxic secondary compounds.

3.Hazards from geneotoxic waste (Park, 2002)**:**The main pathway of exposure is inhalation of dust or aerosols, absorption through the skin, ingestion of food accidently contaminated with cytotoxic drugs, chemicals or other wastes.

4.Hazards from radioactive waste (Park, 2002):It is geneotoxic and thus may affect genetic material. The effect of exposure can range from headache, dizziness and vomiting to malignancies.

5.Public sensitivity: Apart from health hazards, the general public is very sensitive to visual impact of health care waste particularly anatomical waste (Park, 2002). There can be esthetic degradation of the surroundings from the careless disposal.

6.Environmental issue: 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.

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The waste if allowed to accumulate is a health hazard, because: it decomposes and favors fly breeding, it attracts rodents and vitamin, the pathogens, which may be present in the waste may be conveyed back to man's food through fly and dust, there is a possibility of water and soil pollution and heaps of refuse present an unsightly appearance and nuisance from bad odors (Park, 2002).

CLASSIFICATION OF BIOMEDICAL WASTE:

Several classification of biomedical waste have been put forward byHegde et al., (2007).classification divides hospital waste into hazardous and non hazardous.There are ten categories notified in the government of India "Biomedical waste (Management and handling) rules" 1998. They are:

Category No1: Human anatomic waste

Category No 2: Animal waste

Category No 3: Microbiology and Biotechnology waste

Category No 4: Waste sharps

Category No 5: Discarded Medicines and cytotoxic drugs

Category No 6: Solid wastes

Category No7: Solid waste

Category No8: Liquid waste

Category No 9: Incineration ash

Category No 10: Chemical waste

Classification of dental waste:

1. General waste (nonregulated)

2.Contaminated waste

(a). Regulated and (b). Infectious waste

3. Hazardous Waste:

(a). Regulated and (b). Toxic waste

According to US centers for Disease Control and Prevention Guidelines waste are classified in the following waste (Harrison and Nicosia, 1991; Parkash et al., 2011).

ANATOMICAL BIOMEDICAL WASTE

1. **Pathological waste:** Blood, blood products, bodily fluids, and tissues.
2. **Infectious wastes:** Culture infectious agents, associated biological (e.g. culture flasks, petri plates, specimens, vaccines, waste from the production of biological, chemicals, disinfectants, sterilizing agents.

Infectious waste is the part of medical/dental waste that has been shown through controlled studies capable of transmitting an infectious disease. Infectious medical or dental waste is also known as regulated waste (Gordon and Denys, 2001; Kohn et al., 2003; Palenik, 2003; Palenik and Miller,2004).

Nonanatomic biomedical waste

Waste from dental materials/equipment/disposables that appear to be medical waste:

1. **Mercury containing:**Elemental mercury, scarp amalgam.
2. **Silver containing:**Spent X-ray fixer, undeveloped film.
3. **Lead containing:**Lead foils packets, lead aprons, broken thermometers, and blood pressure gauges.
4. **Chemical or Pharmaceutical waste**: Chemicals, disinfectants, sterilizing

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agents, expired drugs, waste bearing cytotoxic/genotoxic properties.

5. **Contaminated/uncontaminated sharps:** Syringes (with or without needles), broken glass, scalpels, specimen tubes and slides.

Regulated waste

Includes all "Sharps" such as disposable needles, scalpel blades, broken glass, burs, endodontic files and reamers, blood, and blood soaked or blood caked items, human tissue,human tissues, extracted teeth, and waste from pathological procedures. Regulated waste requires special disposal in biohazard containers or bags. Since extracted teeth are potentially infectious, they are considered regulated waste. Only teeth without amalgam may be heat sterilized. Teeth containing amalgams can be placed in biohazard containers for pickup.

Nonregulated waste:

Includes items such as used patients bibs, barriers used during treatment, and saliva sokedguaze. If this waste contains potentially infectious materials, if it is considered nonregulated, it should be labeled with a biohazard label.

Hazardous waste:

This could pose a risk to human beings or to the environment. Examples: Scrap amalgam, photochemical waste (developer and fixer), lead foil from traditional X-ray packets, some disinfectants.Waste categories and description as suggested by World Health Organization is given in Table 1.

Table 2: WHO classification of health care waste

Waste category	Descriptions with examples
Infectious waste	Waste suspected to contain pathogens e.g. laboratory cultures, tissues, swabs, materials or equipments that have been in contact with infected patients, excreta etc.
Pathological waste	Human tissue or fluids; e,g. body parts, blood and other body fluids, fetuses etc.
Sharps	Sharps waste; e.g. needles, scalpels, blades, knives, sets, broken glass
Pharmaceutical waste	Waste containing pharmaceuticals, e.g. pharmaceuticals that are expired or no longer needed, items contaminated by or containing pharmaceutics (bottles, boxes)
Genotoxic waste	Waste containing substances with genotoxic properties e.g. cytotoxic drugs (cancer drugs) genotoxic chemicals
Chemical waste	Waste containing chemical substances e.g. laboratory reagents, film developer, fixer, disinfectants that are expired or no longer needed, solvents
Waste with high content of heavy metals	Batteries, broken thermometers, blood pressure gaugesetc
Pressurized containers	Gas cylinders, gas cartridges, aerosol cans
Radioactive waves	Waste containing radioactive substances; unused liquid from

	radiotherapy or laboratory research, contaminated glassware's, packages or absorbent paper, urine and excreta from patients treated or tested with unsealed radionuclides, sealed sources

Steps in waste management:

The various steps involved in the hospital waste management in general are (Park, et al., 2009).

1. **Waste survey:**Quantification and differentiation of waste.
2. **Waste segregation:**Placing different waste in different containers.
3. **Waste accumulation and storage:**Accumulation for temporary holding and storage for longer holding.
4. **Waste transportation:** Waste must be carried out in special containers in covered and closed vehicles.
5. **Waste treatment:**This involves disinfection or decontamination of infectious waste so that is no longer a source of pathogens and can be handled, transported, stored and disposed of safely.
6. **Waste disposal:**Through incineration, microwave irradiation, chemical disinfection, wet and dry thermal treatment, incineration and safe land disposal.
7. **Waste minimization:**Following 3R's (Reduce, Reuse, and Recycle method).

Sharps, Needles etc and their management:

- Needles, glass, syringes, ortho wires, sharp instruments etc must be handled carefully.
- The needles should be by needle destroyer or by using syringe neeting and disposal system.
- The disposal needles and other sharp waste must be mutilated. The mutilated needles and sharps should be placed in puncture proof containers, containing 1% sodium hypochlorite solution (NaOCl) for primary disinfection and after every two days the solution should be changed. It should be sent for shredding, encapsulation, and disposal in landfills by common treatment facilities (http//www.crd.bc.ca).

Sharps, needles etc are regarded as highly hazardous health care waste since they can cause injuries and puncture wounds. Health care workers, waste management workers and rag pickers are at the great risk of transmission of blood borne pathogens such as HIV, hepatitis B and C etc on exposure to the contaminated sharps, needles etc. According to WHO many cases of infection with various pathogens due to exposure to improperly managed health care waste has been well documented. According to US, EPA, the dentists are exposing to viral hepatitis B infection is < V %, where as dental assistants 5-8% resulting from exposure to sharp injuries annually (Darwish and Al-khatib, 2006).

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Universal waste and management

Electronic devices, batteries, fluorescent lamps etc., comes under "universal waste" and consider as hazardous waste and must be managed under its universal waste management regulations (Chandra, 1999).

Chemicals, Disinfectants and Sterilizing Agents

- Most of chemicals, disinfectant and sterilizing agents are toxic and pose a threat to the environment. Halogenated sterilants have a determined effect.
- Staff should be trained in Workplace Hazardous Materials Information System (WHMIS) for the handling of materials.
- Steam or dry heat can be used to sterilize dental instruments, whenever it is possible.
- Non chlorinated plastic containers (not pvc) must be preferred to minimize environmental impacts and placed in solid waste stream.
- Waste glutaraldehyde and orthoptithaldehyde which are the active ingredients of several brands of sterilizing solutions, before pouring them in the sanitary sewer, they should be neutralized with glycine.
- Ignitable sterilantsshould not be poured down the drains as they have potency to explode.
- Formaldehyde sterilants should also not disposed down a drains as the direct pouring of chemicals, disinfectants and sterilizing agents into a septic system may significantly disrupt the bacteria/microorganisms which normally breakdown wastes (Pasupathi et al., 2011).

The dental waste of utmost important is related to lead foil, mercury and mercury related products. Utmost care must be taken and various precautions should be exercised while purchasing, strong handling and disposing these products. Appropriate guidelines on various aspects have been given by American Dental Association(Batchu et al., 2006; Fan et al., 2002; McManus and Fan, 2003).

A scheme outlining various steps involved in managing biomedical waste is modified from Rutala (1989) and American Medical Association (2007) for Dental biomedical waste is as shown in table 3.

Table: 3 Various components of a biomedical dental waste management protocol (modified from Rutala et al., (1989) and American Medical Association (2007)

Steps to be followed for thorough dental BMW management
– Identify the applicable regulations, accreditation standards, and guidelines in the dentist's country, state and municipality for the management of biomedical waste – Based on central, state and local regulations, dentists or health care facilities should develop protocols for biomedical waste management that address the

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following aspects, if applicable

- Definition of dental waste
- Identification of dental waste
- Identification of materials that can be recycled
- Segregation of dental waste from other waste
- Segregation of materials that can be recycled
- Containerization as per appropriate guidelines
- Labeling when needed
- Storage
- Transportation
- Recycling
- Disposal
- Education
- Record keeping
- Develop and conduct an educational program for dental staff

Educate patients involved in home health care/dental care about appropriate disposal of bio-hazardous waste

Verify appropriate implementation of the program

Regularly evaluate and update if required

MERCURY CONTAINING WASTE

Mercury is a naturally occurring metal, however half of the mercury released to the environment comes from anthropogenic activities. Of that amounts, 53% is emitted from combustion of flues for energy production and 34% is from combustion of waste. Sources associated with manufacturers and consumers make up the remains 13%, with dentistry contributing less than 1%. Mercury has potential to be hazardous if not managed properly. It is persistent and deadly contaminant in the water and the environment.The mercury in dental amalgams can be released to the environment through air, water and solid waste. Amalgam handling procedures in dentistry reveals that critical issues for health related safetyarise from when mercury exits in either liquid or vapour form as it can be absorbed through the aleveoli in the lungs at 80% efficiency and through the gastrointestinal tract at efficiency of and 0.01% for elemental, 7% for inorganic and 95-98% for organic (Srinidhi and Ranadive,

2013).Metallic mercury such as that used in amalgam is relatively non toxic. However, when mercury is released into the environment, some portion may be converted into methyl mercury by bacteria, which is potent neurotoxin. Mercury and methyl mercury are bio-accumulative, which means that it can build up in the fish and cause health problems in humans and other animals that eat fish. Methyl mercury biomagnifies in the food chain such that levels of methyl mercury are created that are tens of thousands of times higher in some predatory fish than in the surrounding waters. The Federal Food and Drugs Administration (FDA), USA has determined that any level of methyl mercury in fish above 1mg/l is unsafe. Some mercury released into the air (when dental waste that contain amalgam are incinerated, some of the mercury in the fillings of removed teeth or scarps of amalgam in the waste. Eventually collects in waterways, where it enters in food chain. Fetuses and newborn babies are more sensitive to mercury than adults. The dental mercury contamination is only small proportion of the terrestrial mercury (3-4%) and the environmental impact of dental mercury is mainly due to the poor management of dental amalgam waste (Chin et al., 2000).reviewed on amalgam waste management, and stated that discharge from dentistry is probably responsible for <1% of the total mercury discharged annually into the environment. According to WHO (1999); SEARO, the II South-East Asian countries together produce some 350,000 tones of health care waste per year, close to a 1000 tones a day, which is both hazardous and non hazardous and it is unimaginable production from the entire world in a day and how much burden on the environment.As a precautionary measure one should assume that all or most of mercury released into the air or surface water may accumulate in fish. (American Dental Association, 2007).Types of Amalgam waste generated at dental clinics

Non contact amalgam (scarp) is excess mix leftover at the end of a dental procedure. Many recyclers will buy this clean scarp.

Contact Amalgam is amalgam that has in contact with the patient. Examples are extracted teeth with amalgam restorations, carving scarp collected at chair side, scarp left on instruments and matrix bands and amalgam capture by chair side traps, filters or screens.

Amalgam separators that comply with ISO 11 143 capture over 95% of amalgam waste but also trap other treatment debris.

Chair side traps capture amalgam waste during amalgam placement or removal procedures (traps from dental units dedicated strictly to hygiene may be placed in general waste.

Vacuum pump filters or traps contain amalgam sludge and water. Some recyclers will accept whole filters, while others will require special handling of this material.

Amalgam sludge is the mixture of liquid and solid material collected within vacuum pump filters or other amalgam capture devices.

Empty amalgam capsules are the individually disposed containers left over after mixing precapsulated dental amalgam.

Amalgam waste products can also be a part of operatory air. Adequate fresh air should be mixed with existing office air and the

dental office should be well ventilated. This is of particular interest when nowadays most of the dental offices are air conditioned. Work should be done in well ventilated space and fresh air exchange and outside exhaust. If spaces are air conditioned, the filters of air condition should be replaced periodically (Srinidhi and Ranadive, 2013). The guidelines issued by ADA recommends that only capsulated amalgam alloy complying with ISO 24234 should be used in dental clinics. Dental clinics must collect, store safelyand forward for recycling as much amalgam waste as possible which include used amalgam capsules, excess amalgam not placed in restorations, including that left on instruments and matrix bands, amalgam retained in chair side traps, suction filters and amalgam separators and extracted teeth which have been restored with amalgam. Amalgam separators, which comply with ISO 11 143, should be installed in all dental clinics (http://www.ada.org.ac; Dental Association Council, 1990).According to American Dental Association regulations, mercury contaminated materials should not be placed in medical waste bags because these are burned and mercury becomes vaporized.

Management of vaporous mercury waste: It includes

- Unused elemental mercury must be stored in sealed containers.
- For disposal and recycling a certified biomedical waste carrier must be contacted.
- In case of mercury spill, a “mercury spill kit” must be used.
- Waste elemental mercury must not be thrown and placed in garbage and
- Elemental mercury must not be washed in the drain.
- Sunction traps and disposable amalgam separators must be used on dental suction units
- To avoid amalgam accumulation the suction traps must be changed weekly.
- Extracted teeth filled with amalgam should not be thrown in garbage but must be collected separately as biomedical waste.
- Separate mercury containers must be used to store all scarp old amalgam (HorstedBindslev, 2004; Clifton, 2007).The empty amalgam capsules are non hazardous and can be disposed in the garbage but scarp amalgam should not be disposed in garbage.

Silver Containing Waste and It’s Management

Silver is found in high concentrations, in the form of silver thiosulfate in fixer solutions and rinses from X-ray films. Light sensitive silver halide crystals present in the X-ray film are released as silver thiosulfate during the fixing process. Because of high silver content, used spent X-ray fixed is regulated as a hazardous waste, as in the environment, free ionic silver acts as an enzyme inhibitor by interfering with the metabolic processes of organisms.

Thus spent X-ray fixer used in dental clinics should not be easily rinsed in the drain. The fixer with a recovery unit be mixed with water and developerand disposed down the specific system or sewer after desilvering. Spent developer can be discharged in the

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above systems after dilution with water .The silver must be handed over to the certified biomedical waste carrier.

- Use of digital X-ray system X-ray system must be encouraged (Aggarwal et al., 2011).
- Use of chromium X-ray cleaner must be avoided.
- Unused X-ray films that need disposed must be accumulated in an approved container for recycling by disposal company.

Lead-Containing Waste and Its Management

The lead foil inside X-ray packets and lead aprons may prove toxic as lead may leach into the soil and groundwater in landfill area after disposal. Excessive doses of lead intake may cause:

- Lead attacks brain, damage central nervous system, and cause coma, convulsions and even death.
- Lead interferes with variety of body processes and is toxic to many organs and tissues including heart, bones,blood system and kidneys.
- Damage to reproductive system.

Lead containing waste must be handled over to certified biomedical waste carriers and recycled properly.

Baghele et al., (2015).have developed and divided a simple, clear, cost efficient, effective and implementable dental biomedical waste disposal program considering local requirements of Thane district of Bombay (Table 4) which is quite successful and can be altered or adjusted according to ore's own requirements

Table 4: The proposed simplified biomedical waste segregation scheme for dental clinics

Red Bag	Yellow bag	Blue bag	Black carboy
Disposable injection, syringes, IV set without needle	Anything contaminated by blood or body fluids	Glass bottles	Used or unused sharps
Saline bottles	Body parts	Broken glass	Needles without syringes
Plastic suction tips	Any item which have been in contact with the patient	Discarded medicines	Scalpel blades
Toothbrushes, denture brushes	Bandages, cotton	Antiseptics, disinfectants (not contaminated by body fluids)	Metal objects
Disposable plastic/fiber instruments	Teeth (with/without fillings but without amalgam filling)	Used or unused drug vials	Metal matrix bands
	Dressing and swabs		Broken metal instrument tips
	Disposables such as gloves, aprons, masks, drapes, contaminated wipes, throat packs		Burs
			Endodontic files

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Plastic/rubber tubes Rubber lids of any vial Used plastic draps	Discarded crowns, bridges and cast partial dentures Waxes, guttapurcha points, adsorbent points Disposable impression trays with impression materials Acrylic partial denture, complete dentures, denture teeth Plastic/stones castes Cheek retractors, tongue depressors, wedges Rubber dam material Plastic X-ray pouches (Outer covering) Catheter (after draining) Unwanted laboratory specimen Suture materials without needle	Cartriges and ampoules	broaches, reamers, spreaders, silver points Orthodontic metal breakers, wires, bands Suture needles Broken/discarded ultrasonic tips Metallic bars, clsaps from partial dentures Metal lids of vials All metallic dental implants related materials

X-ray developer and X-ray cleaner solution can be flushed into the drain, till the availability of silver recovery units at individual or collective clinic level or till new regulations by Govt. of India; X-ray lead foils, used lead aprons and collars-suitable recycle or some scarp vendors by them for recycling; Teeth with amalgam fillings should be disposed into the yellow bag after removing the fillings; Waste amalgam, waste mercury, capsules should be stored I tightly sealed unbreakable containers away from heat; Don't dispose any type of amalgam or mercury in any of above bags or black carboy. Once the container is full give it to a suitable recycler; Old and worn out metallic instrument to be discarded after autoclaving to any metal scarp vendor; It would be preferable to store all the X-ray films till any new guidelines from appropriate authorities; X-ray paper, waste acrylic powder, clinic stationary, any article which is not in contact with the patient should be disposed along with municipal waste. All non infectious general wastes to be collected in white colored or transparent plastic bags and handed over to municipal waste collectors; Appropriate bags and containers provided by the company for the respective purposes should only be used; The regulations would be revised on a timely basis; Developed by the authors in consultation with Indian Dental Association, Thane Branch (India) and Enviro-Vigil, the biomedical waste disposal agency.

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CONCLUSION

Dental Biomedical waste Management program in all dental clinics, hospitals and teachings institutions, must assure proper identification, segregation, contaminants, storage, labeling and disposed of dental biomedical waste. The parameters must be established for the safe handling and treatment of dental biomedical waste. The work force handling, the kind of waste should be thoroughly trained. The dental biomedical waste management plants should be made and implemented properly and effectively.

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