Current Concepts of Biomedical Waste Management and Dental Practice

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INTRODUCTION

Modern dentistry has been described as probably among the least hazardous of all occupations, although there remain many hazards in dental practice such as exposure to infectious diseases, radiation, and mercury. Where the hazards cannot be excluded from the workplace, good occupational hygiene practices need to be adopted by dental practitioners. However, there is probably less awareness of the environmental impact we dentists have as individuals in our professional lives and of the remedial measures we should be taking. Chemicals used, such as etchants and monomers, X-ray processing solutions, and drugs, cause inactivation of the biological systems. Contaminated needles and scalpel blades have been sources of infection and allergies. Base metal debris and mercury from amalgam cause poisoning of the biological systems. Liquid waste containing toxic substances flushed down a drain or sink to sewers, and it might affect the biological waste treatment works in the sewers. Blood, body fluids, and body secretions which are constituents of biomedical waste harbor most of the viruses, bacteria, and parasites that cause infection.

Improper practices, such as dumping of biomedical waste in municipal dustbins, open spaces, and water bodies, lead to the spread of diseases. Emissions from incinerators and open burning also lead to exposure to harmful gases which can cause cancer and respiratory diseases. Exposure to radioactive waste can in the waste stream can also cause serious health hazards. Biomedical waste can cause health hazards to animals and birds. Hence, as a measure for the safe disposal of dental waste, different organizations

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around the globe have developed regulations to safeguard the natural environment.

BIOMEDICAL WASTE CAN BE OF VARIOUS TYPES

Health Hazards of Healthcare Waste

- It contains infectious agents
- It contains toxic or hazardous chemicals or pharmaceuticals
- It contains sharps
- It is genotoxic and
- It is radioactive.

Treatment and Disposal Technologies

Incineration

It is a high-temperature dry oxidation process that reduces organic and combustible waste to inorganic incombustible matter and results in a very significant reduction of waste-volume and weight.

Types of incinerators

- Double-chamber pyrolytic incinerators
- Single-chamber furnaces with static grate
- Rotary kilns operating at high temperature.

Chemical disinfection

Used chemical sterilizer waste may be discharged into the sewer system. Flush the drain well when disposing of this waste. Any unused chemical is a hazardous waste if it has a flash point below 140°F, or if it contains high concentrations of formaldehyde.

Wet and dry thermal treatment

Wet thermal treatment/steam disinfection is based on exposure of infectious waste to high temperature and pressure.

Screw-feed technology is the basis of a non-burn, dry thermal disinfection, in which waste is shredded and heated in a rotating auger.

Microwave irradiation

The water contained within the waste is rapidly heated by the microwaves, and the infectious components are destroyed by heat conduction.

Land disposal

Only when means to treat waste before disposal is not available.

Inertization

The process involves mixing waste with cement and other substances before disposal, to minimize the risk of toxic substances contained in the wastes migrating into the surface water or ground water.5,6

The Biomedical Waste (Management and Handling) (Second Amendment) Rules, 2000

In exercise of the powers conferred by section 6, 8, and 25 of the environment (protection) act 1986, the central government, on 2nd June, notified the rules for the management and handling of biomedical waste. These rules are called the BioMedical Waste (Management and Handling) (Second Amendment) Rules, 2000. These rules apply to all persons who generate, collect, receive, store, transport, treat, dispose, or handle biomedical waste in any form. According to this, “Biomedical waste” means 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 biological.6

PLANNING

A regulated waste management plan contains a number of important components. These include:

1. Designation
2. Categorization
3. Segregation
4. Handling and storage
5. On-site treatment
6. Treatment off-site
7. Contingency planning
8. Public relations.

Designation

Many people mistakenly consider the terms hospital waste, biohazardous waste, biomedical waste, red bag waste, medical waste, and infectious waste to be synonymous. However, hospital waste, dental office waste, or household waste refer to the total discarded solid waste (which includes solids, liquids, semi-liquids, and gases) generated by all sources within a given location.7

Categorization

Many categories of infectious waste have been proposed. The real qualification is if an item or material meets the scientific definition of “shown capable of producing an infectious disease.”

For dental offices, there are five types of regulated waste. All five possess the capabilities of transmitting infectious diseases, and therefore, require special handling, storage, and disposal methods.

Segregation

All waste from dental offices can be divided into two basic categories: Regulated and non-regulated. Regulated waste must be placed into appropriately designed containers, usually red biohazard bags or sharps boxes. Ideally,
segregation should occur as close as possible to the point of origin. The person disposing of an item should know best which type of container to select. Segregation increases patient and practitioner safety and prevents contamination of non-regulated waste.\(^8\)

**Handling and Storage**

Safe handling of regulated waste is essential. Written procedures will help in this process. Involved personnel must be informed of the possible health hazards present and trained in appropriate handling, storage, and disposal methods. Stored regulated waste must be placed into labeled or color-coded bags or containers. Usually, such items are red and have biohazard symbols attached. The receptacles should be covered with properly fitted lids that can be opened with a foot pedal.\(^9\)

**Non-hazardous waste**

Disposable paper towels, paper mixing pads, disposable covers of operating surfaces should be discarded in separate covered containers made of durable material such as plastic or metal receptacles. For ease in handling, the receptacles should be lined with plastic bags.

**OSHA housekeeping requirements**

The housekeeping section of the OSHA Bloodborne Pathogens Standard includes provisions for handling:

- Contaminated sharps
- Spills
- Broken contaminated glassware
- Regulated waste.

**Sharps**

The term sharp means any sharp or pointed object that can penetrate the skin or oral mucosa. In dentistry, the most common types of sharps are:

- Needles
- Scalpel blades and disposable scalpels
- Exposed ends of dental arch wires
- Broken glass
- Burs and endodontic instruments.

The OSHA Bloodborne Pathogens Standard contains specific guidelines concerning sharps containers: Sharps containers must be closeable, leak-proof, puncture-resistant items labeled with a biohazard symbol or color-coded red to identify it as a hazard. They should be capable of maintaining their impermeability during storage, transport, treatment, and disposal. This will help prevent occupational exposure to container contents. Sharps should be quickly placed into sharps containers after use. They must be placed into acceptable containers as close as practically possible to their point of use. Sharp items should be considered as potentially infectious materials and thus handled with extraordinary care to prevent accidental injuries. Contaminated sharps are never touched with bare hands, but by wearing appropriate gloves or using transfer forceps. Sharp containers should be replaced routinely before they are over filled.\(^10\)

**Discarding used needle**

Of special concern among contaminated sharps are used needles. The CDC estimates that healthcare workers sustain nearly 600,000 percutaneous injuries annually involving contaminated sharps. In response to a continuing concern of exposure and the development of technological advances that increase employee protection, the US Congress passed the Needle Stick Safety and Prevention Act in 2000. Enforcement of the new provisions in the standard began on July 17, 2001.

Proper handling of sharps is essential because personal protective barriers, such as gloves, will not prevent all needle stick accidents. 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 must be used. The hands-free technique involves the use of a cap holder, which allows the slipping of the needle into it without touching it.

**Infectious material spills**

The area of spillage is wetted with a suitable disinfectant such as 1:10 sodium hypochlorite solution infectious material spills. Spilled or dropped potentially infectious materials, such as gauze saturated with blood, must be cleaned up immediately. Utility gloves and protective barrier clothing are worn.

**Broken glass**

If contaminated broken glass or something sharp drops do not pick it up with the hands. Instead, use tongs, forceps, or a dustpan and brush. Discard, clean and disinfect, or sterilize items used for this purpose. Broken glass or dropped sharps are discarded in the sharps container. After the sharp material has been removed, disinfect the area as after a spill.

**Discarding local anesthetic cartridges**

If the glass anesthetic cartridge is broken, pick up the broken glass as previously described and discard the broken glass with the sharps. If the glass anesthetic cartridge is not broken and not visibly contaminated with blood, discard it with other non-hazardous waste. If the glass anesthetic cartridge is visibly contaminated with blood, discard it with regulated waste.\(^4\)

**Laboratory specimens**

Medical lab specimens, such as biopsy samples of suspected oral cancerous lesions, to be transported outside of the office for evaluation must be placed in leak-proof bags and labeled appropriately. Dental impressions must also be placed in leak-proof bags and labeled appropriately.
Contaminated laundry
The dental personnel should either use disposable uniforms or make arrangements for laundering or professional cleaning of protective clothing. Clothing dispatched to a commercial laundry should be packed in red laundry bags, clearly labeled with a biohazard symbol.

Mercury from dental amalgam
Placement and removal of dental amalgam restorations generate amalgam waste particles that can be suctioned into the dental unit vacuum line and discharged into the public sewer system. Waste water treatment plants are facing increasing pressure from environmental regulators. Treatment plants are looking to identifiable sources of mercury or mercury-containing waste. Mercury compounds may be absorbed by organisms and concentrated as they pass up the food chain. However, available data suggest that the solubility of the metals in amalgam, in tap water or sewerage is very low.

Amalgam disposal
Three aspects of amalgam waste may be considered.
• Amalgam scrap
• Other waste contaminated with amalgam
• Amalgam in waste water.

Amalgam scrap
Amalgam scrap is stored under radiographic fixer solution in a covered container, and it should be recovered and recycled whenever possible. It is considered as hazardous waste with chances of mercury leaching out of amalgam scrap. Hence, they should be disposed off as required for that of a regulated waste and as per local regulations. It should not be disposed with waste that would be eventually incinerated since amalgam decomposes on heating.\(^1\)

Other waste contaminated with amalgam
Like amalgam capsules, extracted teeth with amalgam restorations, cotton rolls and gauze with amalgam particles. Here again, they should not be incinerated and should be recycled or disposed off as regulated waste in sealed leak-proof bags.

Amalgam in waste water
• Chairside traps and vacuum pump filters
• Sedimentation tanks
• Electrical and chemical separation
• Commercially available amalgam separators.

Amalgam separators
They are devices used to remove amalgam waste particles in dental office discharge by several separation techniques, either alone or in combination, such as:
• Sedimentation
• Filtration
• Centrifugation
• Ion exchange.

Management of mercury spills
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. In case the shoes are contaminated with the spilt mercury, the person is asked not to walk around or leave the spill area until the contaminants are removed. Sprinkling of sulfur powder on mercury spills has shown to be ineffective and inadequate to control the problem because of the slow reaction. Mercury spills are cleaned up properly by using trap bottle, tapes, or fresh mixes of amalgam to pick up droplets, or use commercial clean up kits. If the floor carpeting in the operatory gets contaminated with mercury, removal of the carpeting may be the only effective way to ensure decontamination. Chemical decontamination of the carpeting may be ineffective since mercury might seep through the carpet and remain inaccessible to the decontaminant.

Managing silver and lead waste
Silver in used radiographic fixer solutions
Use of an in-office silver recovery unit to remove silver from used fixer solutions and recycles the used cartridge. Send used fixer solution to a silver reclaiming facility. Send it to a medical radiology lab or a commercial photographic processing lab on agreement.

Lead foil in intraoral radiograph film packets
Should be collected and recycled through a licensed facility. The same would apply to lead aprons and lead collars.

ON-SITE TREATMENT
Many areas allow in-house treatment of regulated medical/dental waste. An easy and effective procedure is sterilization by moist heat (autoclaving). Dry heat ovens should not be used. Of course, the performance of the sterilizer must be biologically monitored regularly.

Where allowed, sharps containers can be sterilized in-house. The open containers should be placed into the sterilizer in an upright position. In-house treated regulated waste items can then be added to the non-regulated office waste. These items should be labeled as “treated” or with other information as required by local laws. Pathologic waste is considered to be potentially infectious and must be regulated. Teeth without amalgam restorations and other tissues can be placed directly into a biohazard bag or a sharps container.
TREATMENT OFF-SITE

Some areas may require regulated waste be removed, neutralized, and disposed of by a commercial waste hauling service, regulated by the local government.

PUBLIC RELATIONS

A good portion of the population has an aversion to blood (liquid or dried) and medical/dental sharps, especially needles. Such anxiety also can exist among those charged to collect, haul, and dispose of waste. It would be best if properly treated and labeled regulated waste containers were placed within some other type of container (e.g. cardboard boxes) that can more readily conceal the actual contents. This is an example of “out-of-sight … out-of-mind.”

CONCLUSION

It is best if offices prepare sets of written procedures concerning their regulated waste. Such prepared programs should always list the person or persons responsible in the event of an emergency. The success of any safety program is highly dependent on proper employee training and employer monitoring. All office personnel must be well versed in the handling, storage, treatment, and disposal of regulated medical waste.

REFERENCES


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