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A Study on Management of Dental Health Care Waste: Hyderabad Experience

Dr Sukhvinder Bindra, Dr Neha Mehrotra, Dr Kirti Chaudhry, Dr Kriti Nagpal

Abstract:
Background: *Dental health care procedures generate significant amount of waste materials which could be potentially harmful to environment and community health.*
Aims and Objective: *The present study has been undertaken to assess the concern of dental health care providers at Hyderabad, India towards handling and disposal of dental waste generated.*
Material and Methods: *A structured questionnaire of 18 questions was handed over to 294 participants. The study population included undergraduate students (Group 1) and post graduate students (Group 2), dental practitioners (Group 3) and auxiliary staff (Group 4). The data was analysed using chi square test.*
Results: *95.6% participants were aware of biomedical waste and various categories of biomedical waste were known to (85.0%). 50.3 % followed a systematic method of segregation of waste. 35.4% disposed sharps in sharps bin. Mercury spill kit and amalgam separator was not being used by 77.2 % and 74.5 % respectively.97.3% discouraged flushing silver filling in the drain. 45.9 % disposed human anatomical waste in yellow plastic bags.*
34.7 % flushed used radiographic fixer in drain and 56.8 % disposed lead foil packets and aprons into regular bins. Majority did not use black plastic bag to disposed expired medicines.
72.4 % agreed that the liquid waste generated was drained in the sewer water.
Conclusion: *There is a definite need to create awareness, improve knowledge, inculcate responsible attitude, and adopt proper methods to dispose dental health care waste to minimise its harmful effects.*
Key words*: Dental health care providers, dental waste, amalgam, mercury, radiographic fixer*

I. Introduction

Dentistry is growing rapidly across the globe, and India is also participating actively in adopting new trends and methods in providing dental health care. A rapid increase is observed in the number of dental clinics across the nation. With this, quality of dental health and patient care is enhanced manifolds .But on the other side; it has contributed at large, in generating significant amount of dental health care waste.

As per WHO norms the health-care waste includes all the waste generated by healthcare establishments, research facilities, and laboratories As per Bio-Medical Waste (Management and Handling) Rules, 1998 and amendments of India, bio medical waste is defined as any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining there to or in the production of testing of biological and including categories mentioned in schedule 1 of the Rule, is the bio-medical waste .

The issue of improper Hospital Waste Management in India was first highlighted in a writ petition in the Hon'ble Supreme Court; and subsequently, pursuant to the directives of the court, the Ministry of Environment and Forests, Govt. of India notified the Bio-Medical Waste (Management and Handlings) Rules on 27th July 98; under the provisions of Environment Act 1986. These rules have been framed to regulate the disposal of various categories of Bio-Medical Waste as envisaged therein; so as to ensure the safety of the staff, patients, public and the environment (1, 2).

Environment problems in terms of air, water and land pollution arise from the mere generation of health care waste and from the process of handling, treatment and disposal (3). In addition, the serious threat arises when some community members collect the disposable medical items, repack and sell without sterilization.

Dentistry is a multispecialty unit of health care services which generates variety of waste materials e.g. cotton, plastic, latex, sharps(4), extracted teeth, amalgam particles, waste mercury, fixers, developers, x-ray film packets, discarded and unused medicines, and chemicals. Even though hazardous waste represents a small proportion of total dental solid waste, there is still a risk for cross infection (5) .Dental wastes are potentially harmful to the environment and require specific treatment and management prior to its final disposal(6).

II. Aims and Objectives

The present study has been undertaken to assess the concern of dental health care providers towards handling and disposal of dental waste generated.

III. Material and methods

This was a cross sectional survey conducted on 294 participants .The study population included 4 groups i.e.undergraduate students (Group 1), post graduate students (Group 2), dental practitioners (Group 3), and auxillary staff (Group 4).

All participants were given a structured questionnaire which included 18 closed ended questions along with necessary instructions. The questions were designed by authors in a manner to obtain information about disposal of dental waste in terms of categories, colour coding, and segregation of waste of biomedical waste and the methods adopted to dispose dental amalgam, extracted teeth, x ray films and fixing solutions and expired medicines.

The data was analyzed using SPSS 17.0. The results were analyzed using chi square test and p value was used to indicate the statistical significance. $P< 0.05$ was considered significant at 5 % level ,$p< 0.01$ was considered significant at 1% level and $p> 0.05$ was considered non significant.

IV. Results

294 participants were quantized into four groups (Figure 1).All groups (95.6%) were aware of what biomedical waste is and among groups, and awareness was least observed in (group 4) auxiliary staff members. Various categories of biomedical waste were known to all groups (85.0%) and dental practitioners (Group 3) outnumbered the other groups for having knowledge of categories of waste.

Although statistically insignificant but 60.2% of the total participants were following the colour coding system of waste disposal and among groups and this was being followed maximum by dental practitioners (Group 3). 50.3 % members of the study practised a systematic method of segregation of waste but (61 %) post graduate students were lacking this practice.

Sharps were being disposed in sharps bin by only 35.4% of the total participants. Among all groups, maximum number of (61.7 %) post graduate students (Group 1) was found throwing sharps in regular bins followed by auxiliary staff members.

77.2 % of the study population agreed that they did not have knowledge of using mercury spill kit and this ignorance was noticed maximum in students (Group 1). 74.5 % gave consent that amalgam separator was not being used in their practice and this lack of knowledge about amalgam separator was reported with highest frequency by auxiliary staff members (Group 4).

Regarding disposal of silver fillings and extracted teeth with silver fillings, use of regular dust bin was discouraged by 60.9 % of the participants, but auxiliary staff members were found using regular bins for throwing discarded silver fillings. Maximum number of Dental practitioners (69.2%) reported that regular dust bins were not being used by them.

Silver fillings were not being flushed in the drain by 97.3% of the study population. Disposal of silver in a fixer container and in red hazardous bag has been suggested by 49.3 % and 10.9% of the total participants. It was also observed in our study that 86 % of the study population was not recycling the discarded silver fillings.

Human anatomical waste (extracted teeth and biopsy specimens) was being disposed in yellow plastic bags by 45.9 % of the total sample size. Among all groups, under graduate students (68%) were not following this system, followed by post graduate students (57.4%).

Used x ray fixer solution was found being flushed in the drain as such by 34.7 % and after dilution by 39.5 % participants. Private practioners (23.7%) consented for selling used X ray fixer solution in market. X ray films were being disposed in regular dust bins by the students 62.1 %(Group 1).

Although non significant but it was revealed in our study that lead foil packets and aprons were thrown into regular bins by 56.8 % of the study population.Used waste gloves, mouth mask and head caps were being disposed in regular bin by 70.1 % .

Black plastic bag to dispose the expired medicines and red or yellow bag to dispose waste cast were not being used by the majority. It was agreed by 72.4 % of total participants that the liquid waste generated from washing, cleaning and housekeeping was not being chemically treated before disposing into the sewer water.

Oold dentures, prosthesis and impressions were disposed in a regular bin by77. 9 % and surprisingly dental practitioner group reported with highest frequency.

V. Discussion

Infectious, chemical , and hazardous contents in dental health care waste make its management very complex (7).Poor dental waste management exposes the workers of health care facility , waste handlers and community as a whole to infection, toxic effect and injury. Lack of information continues to lead dental professionals to contribute to environment degradation (8). The present study was a small effort to assess the attitude of dental health care providers of Hyderabad city in India towards dental waste management.

In our study all groups were aware of biomedical waste (95.6%).This is in contrast to the study conducted by Alok Sharma et al (9), where they concluded that only 30 % of the dentists were aware of bio medical waste. In another study conducted in New Delhi, India, among the 64 dentists who were teachers in Government institutions reported that the majority of the respondents were not aware of the proper clinical waste management regulations (10).This could be attributed to the fact that our study has been conducted recently and there is increase in awareness about biomedical waste from past to present.

There are different categories of biomedical waste which are described in [Table 1]. Segregation of different categories of waste plays an important role in the entire process of waste management. Hazardous and non hazardous waste should be segregated in order to reduce the rate of infections. Separate containers should be used to help distinguish between medical and general waste. All containers for biomedical waste must display the biohazard symbol and the words Biohazard in a color contrasting the container as per color coding system [Table 2].

It is now universally accepted that segregation is the responsibility of the generator of the waste. However, this responsibility is always relegated to the sanitation staff and it becomes difficult to appropriately segregate and dispose the way in desired manner. This has been observed in our study that only half of the study population is following the systematic method of segregation of waste. This has also been found by Bdour A et al (11) in their study.

This study reveals that although there is awareness about biomedical waste but there is a definite scope of improvement and educating staff to follow appropriate methods of segregation and color coding system for waste disposal.

Sharps management is crucial .If sharps are not disposed with utmost care, it can cause serious injuries to the waste handlers. Injuries from sharps can result in serious blood borne infections such as Hepatitis C (HCV),Hepatitis B (HBV) and AIDS. Epidemiological studies indicate that a person who experiences one needle stick injury from a needle used on an infected source patient has risks of 30%, 1.8%and 0.3% respectively to become infected with HBV, HCV and HIV (12).

All sharps must be disposed using appropriate guidelines. Sharps should be managed by collecting them in separate container which should be rigid, leak poof , puncture resistant , sealable and remain in good condition during their entire usage. This may contain 1 % sodium hypochlorite solution which should be changed at least once daily. Unfortunately sharps were being disposed in regular bin by majority. This is in line with findings of literature (6) and (7) where it is concluded that sharps were collected in bags without bins, thus exposing waste handlers to sharps injuries. Among groups, this finding is more common seen in students as they are less experienced and new to profession.

These findings suggest that training is required at all levels of dental practice for proper disposal of sharps. Induction programmes should be conducted for all new recruits and concept of universal precautions should be explained to all dental health care workers. Information about risks from sharps injuries and desired methods for sharps handling can be displayed on posters in all dental health care clinics and institutes.

Mercury waste problems of dental clinic have been given increased attention due to hazardous effects of mercury accumulation in ecosystems (13) and mercury is known to be neurotoxic and nephrotoxic. One long-term study suggests that prenatal exposure to methyl Hg from the consumption of Hg-contaminated fish can produce neurobehavioral abnormalities in children (14). Dental clinics are responsible for the major amount of mercury waste which is generated in the form of amalgam particles and mercury spills.

Accidental mercury spills are not uncommon in dental practice. A spill is considered small if there are less than 10 grams of mercury present and large if it is more than 10 grams (15). Small spills can be cleaned safely using commercially available mercury clean up kits which chiefly contains a pair of nitrile gloves, scoop and scraper, absorbant activator bottle, safety shield, mercury caution label and instructions. In present survey 77.2 % of the participants were ignorant about the mercury spill kits. This shows that there is a need to inform all personnel involved in the handling of mercury and dental amalgam regarding the potential hazards of mercury vapour and inculcate responsibility of observing good mercury hygiene practices.

Amalgam containing water is released from dental clinics, with a possible risk of adding significantly to the mercury burden in sludge, thus preventing recycling. This problem can be solved relatively easily by installation of efficient amalgam separating devices (16).

Amalgam Separator is a device that collects amalgam particles. Chair side amalgam filtration systems are effective in removing substantial amounts of Hg from dental unit waste water. The filters retain amalgam waste at the chair, thereby limiting the deposition of amalgam downstream in plumbing lines where Hg could leach over time. Another advantage of a chair side location is that maintenance of the separator is more convenient and there is no need to visit a utility room to check on the status of the separator(17).

In present study, ignorance is observed about the usage of chair side amalgam separator. This is in agreement with the study conducted by Kontogianni (18) who found that none of the dental units used amalgam traps or separators installed in chair side washstands or waste water pipes to avoid amalgam disposal to sewage.

Contact amalgam is the amalgam that has been in contact with the patient. Contact amalgam and extracted teeth with amalgam should be disposed in a covered plastic container labled as amalgam for recycling and recycler should be consulted for the above (19). In present study practice of recycling of amalgam is lacking.

Human anatomic waste include body parts, biopsy tissues and extracted teeth. This should be disposed in yellow bags or containers (20). When refrigerated storage is available, anatomical waste shall be frozen or chilled to minimise decomposition of the material during on site storage. The containers must not be filled more than 3/4 full and must be sealed tightly shut to prevent escape of the waste. This practice is found in only 45 % of the sample size. This could be explained by the fact that there is lack of knowledge about the categories of the waste and colour coding system of the waste disposal.

Used radiographic fixer (a solution normally used in the processing of dental radiographs) contains silver which is another heavy metal that can enter our water system via improper disposal of dental office waste though it is generated in a very small amount in comparison to other photographic processing facilities (21).

Spent fixer solution contains approximately 4000 mg of silver per litre .Because of these high silver levels; it is illegal to drain used fixer into a septic system or into the garbage. The best way to manage silver waste is through recovery and recycling.Dentists can install in-house silver recovery units to salvage the silver themselves, and once the container is full, a Certified Waste Carrier for recycling or disposal can be contacted, allowing for some monetary return on the equipment investment when the silver is later sold. To ensure the maximum amount of silver is being removed, make sure the unit is maintained and is working properly (22) .This is very encouraging to find in our study that 65.3% are not flushing the used fixer in drain which is not in agreement to the findings of Zohara Kayamali (23) who noticed that 50.8% dispose the developer and fixer solution by letting into sewer.

Unused X ray films should not be placed in the regular bins as they contain unreacted silver that can be toxic in the environment. 56. 1% acknowledged of throwing X ray films in regular bins. Safe disposal can generally be accomplished by simply contacting the supplier of the product and returning the waste for recycling. Exposed radiographic films are harmless and can be considered as general waste.

Lead waste is generated at dental offices in foil from intraoral film packets, discarded lead aprons and collars. This waste can contaminate soil and groundwater, if placed in regular garbage, and sent to a landfill. Lead foil and aprons/shields should not be disposed of in the regular trash and should be recycled for their scrap metal content. Reducing environmental lead contamination by dental practitioners is an inexpensive and easy task. Lead aprons can be used for several years with good management. The lead shields from film packets merely have to be collected and returned periodically to the manufacturer for recycling (24). Although non significant but it had been observed in our study that lead foil packets and aprons have been thrown into regular bins by 56.8 % of the study population. This is also observed by Zohara Kayamali (23) in their study.

Expired medicines should be collected in black bags and should be disposed in secured landfill as they are cytotoxic but majority are not following this. Similar findings have been reported by (25) Hisu Yu chen that 88% of unused and expired medication are flushed down the toilet or discarded as regular household waste trash, causing severe environmental contamination.

Gypsum waste like dental casts and models should be sent for recycling and disposed in a landfill in a separate and specific cell. Most dental study models will contain gypsum which, when land-filled, can produce hydrogen sulphide gas therefore they can no longer be disposed of in normal commercial/trade waste (or as clinical waste). Local authority waste departments should be able to identify appropriate local facilities where this waste can be taken to be either recycled or appropriately disposed of. Results of various research have indicated that calcium sulphate dehydrate can be reproduced using previously fabricated casts (26)

The present study reveals that there is lack of knowledge and awareness about proper dental waste management among dental health care providers. Although Rules have been formulated to improve overall health care waste management in India but the introduction of law is not sufficient for proper disposal of bio medical waste. The awareness of these laws among the general public as well as development of policies and enforcement that respect those laws are essentials (27).

The present study was conducted on small scale. Further research can be considered to have evidence based results.

VI. Summary and Conclusion

Training should be provided to all personnel involved in dental health care i.e. doctors, nurses, dental technicians, auxiliary staff , sanitation attendants , students and waste handlers. Training should be interactive and have demonstrative sessions. Biomedical waste management chapter should be included in study curriculum of students and continuing dental education programmes. Responsible attitude and abiding by laws to minimise dental waste production and proper handling of waste will benefit our society and environment.

Conflict of Interest: None

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