

Knowledge, Attitude and Practices towards Biomedical Waste Management Among Dental Post Graduate Students in Lucknow City- A Cross Sectional Study

Benazir Alam¹, Shitanshu Malhotra², Manu Narayan³

¹Post graduate student, Department Of Public Health Dentistry, Career Post Graduate Institute Of Dental Sciences And Hospital, Lucknow, Uttar Pradesh, India;

²M.D.S, Reader, Department Of Public Health Dentistry, Career Post Graduate Institute Of Dental Sciences And Hospital, Lucknow, Uttar Pradesh, India;

³M.D.S , Head of department, Department Of Public Health Dentistry, Career Post Graduate Institute Of Dental Sciences And Hospital, Lucknow, Uttar Pradesh, India

Corresponding author:

Dr.Shitanshu Malhotra

17/646, Indira Nagar, Lucknow (Uttar Pradesh), 226016

Email: malhotra.shitanshu@yahoo.co.in

ABSTRACT

Aim:To assess the knowledge, attitude and practices towards biomedical waste management among dental post graduate students in Lucknow city- a cross sectional study.

Settings and design: A descriptive cross- sectional survey was conducted among the dental students (300 students) in Lucknow city.

Materials and method: Total sample size from 5 dental colleges achieved was 300. Knowledge, attitude and practice towards dental waste management was assessed using pretested structured questionnaire containing 28 items.

Statistical analysis:Discrete (categorical) data will be summarized in number (n) and percentage (%) and will be compared by Chi-square (χ^2) test. A two-tailed $p < 0.05$ will be considered as statistically significant. Analysis will be performed using SPSS (Statistical Package for Social Sciences) software version 23.

Results: Out of 300 participants 30% were males and 70% were females. Majority (93.7%) of dental students were aware of the term biomedical waste and also most of them (97.7%) had a positive attitude regarding decontamination reducing the chances of infection.

Conclusion: Though dental students have good knowledge but they were not aware of colour coding in disposing the infectious waste and not practicing appropriate method of handling the dental waste.

Keywords: biomedical waste, post graduate, dental waste.

Introduction

The key to an individual's health lies largely in his environment and much of his ill health can be traced to adverse environmental factors like pollution. It is ironical that we as dental professionals, providing dental care in hospitals and clinics that bring relief to the sick can create health hazards due to improper management of waste generated in hospitals and clinics and can contribute significantly to the environmental pollution.^[1] In general, medical and dental clinics produce a variety of wastes that are classified into: hazardous and non-hazardous waste, biohazardous waste, as well as sharps and pharmaceutical waste.^[2]

Biomedical waste (BMW) is defined as any waste generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining hereto or in production or testing of biological, and including categories mentioned in schedule I of Biomedical Waste (management and handling) (second amendment) Rules 2000, by Ministry of Environment and Forests notification.^[3] The hazards of BMW can range from tuberculosis, septicaemia, tetanus and skin infections to more deadly diseases such as AIDS and hepatitis. One of the main causes for the spread of these infections is the improper disposal of waste in health care facilities.^[4] In 2015, the Central Pollution Control Board, India, has estimated that 169,913 health-care facilities (HCFs) of India have generated approximately 495.30 tons/day biomedical waste, which roughly translates into 0.5–2 kg/bed/day.^[5]

Bio-medical waste collection and proper disposal has become a significant concern for both the medical and the general community.^[6] The doctors, dentists and other healthcare workers spend maximum time with patients in their working institutions or clinics. Dental waste is a subset of biomedical waste.^[7] Improper disposal of dental waste can cause harm to the Dentist, to the people in the immediate vicinity of the Dentist who handle the materials, to the waste handlers or the general public at large through production of toxins through incineration. BMW management is a teamwork requiring cooperation and coordination of doctors to ward boys.^[8]

Dental postgraduates are required to know in depth about the proper management of dental waste in order to minimize the risks of cross infection and effects of toxins released into the environment. Postgraduates in dental as well as medical field come across various types of cases and majority of these cases are treated by them. Therefore, it is essential for them to be aware of BMW management and its potential hazards to avoid associated risks.

Even though there is increased global awareness among health care professionals about threats and also suitable management techniques, in India, the level of awareness has been found to be unsatisfactory.^[9] As there is not much available information in which it describes the actual practice followed in handling these types of waste products, so this study is aimed to assess the knowledge, attitude and practices towards biomedical waste management among dental post graduate students in Lucknow city. The objectives of the study were to assess the postgraduate student's awareness about dental care waste management and to know the various methods of biomedical waste management practiced by dental post graduate students.

Materials and methods

Lucknow, the capital city of Uttar Pradesh is situated 123 meters above the sea level. It covers a geographical area of 2528 square kilometres with a population of 4,588,455 (2011 census). A descriptive cross-sectional questionnaire based survey was conducted among post graduate students of five dental colleges in Lucknow city. One cross sectional survey, advocating 50.0% to 98.0% knowledge towards biomedical waste management among undergraduate dental students of Bapuji Dental College and Hospital in Davanagere city^[7] was used to calculate the sample size. The total sample size obtained was 288. Expecting 75.9% knowledge towards biomedical waste management among postgraduate dental students of Lucknow city, India with considering 5.0% margin of error and 80% power, and also keeping in mind the dropout rate and incomplete information, the sample size for the present study was increased to 300. The post graduate students were selected by simple random sampling method following the lottery method of selection. A total of twenty students were selected from each year making 60 post graduate students from each dental college. This way the total sample size from five dental colleges achieved was 300.

Postgraduate students who were willing to participate in the survey and those who were present on the day of the survey were included in the study. Postgraduate students who were absent or who were not willing to participate in the survey were excluded from the study. Also the students who did not respond to all the questions in the form were excluded from the study.

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Ethical clearance was obtained from the Institutional Ethical committee of Career Post Graduate Institute of Dental Sciences and Hospital, Lucknow. Prior permission to collect the relevant data from the postgraduate students was obtained from the respective college authorities. All the potential participants were detailed about the purpose of the study. The subjects were appraised that if they participate in the study, they need to answer a questionnaire containing 24 questions. A voluntary written informed consent was then obtained from the study participants.

The pilot study was conducted among 30 post graduate students in which the questionnaire was pretested and modifications were made accordingly. Cronbach's alpha was 0.70 and test-retest analysis showed a good reliability of 0.7 of the questionnaire. Those students who were involved in the pilot study were excluded from the final study. The questions were assigned one point each for the correct answer and zero point for the wrong answer.

A specially designed, structured and close ended questionnaire in English language was used in the present study to collect the knowledge, attitude and practice of study sample. It comprised of 28 items which was given under two sections:

- Section I: To collect the demographic details of the participants like age, gender, and the years of experience.
- Section II: Contained three parts.
- Part A contain 8 questions regarding knowledge towards dental waste management.
- Part B contains 8 questions regarding attitude towards dental waste management.
- Part C contains 8 questions regarding practices towards dental waste management.

A schedule of study was prepared prior to data collection. The study was carried out in the month of November 2020 and was conducted within the working hours of the college, as per the time allotted by the principal.

Discrete (categorical) data will be summarized in number (n) and percentage (%) and will be compared by Chi-square (χ^2) test. A two-tailed $p < 0.05$ will be considered as statistically significant. Analysis will be performed using SPSS (Statistical Package for Social Sciences) software version 23.

Results

The present study was conducted to assess knowledge, attitude, and practices towards biomedical waste management of dental post graduate students in Lucknow city. The study comprised of post graduate students from all the specialities. The maximum age of participants who participated in the study was 35 years and the minimum age of participants who participated was 25 years (mean = 27.04 \pm 1.85).

Out of 300 dental post graduate students, majority of the participants were female (70%). 98.3% participants had less than 5 years of experience whereas only 1.7% of participants had more than 5 years of experience.

Discussion

This study was an effort to investigate knowledge, attitude, and practices towards BMWM among post graduate students of dental colleges in Lucknow city. BMW contains infectious agents, toxic or hazardous chemical or pharmaceutical, sharps and it may be genotoxic or radioactive; it is potentially risky for persons who are exposed to it and to the general population and the environment as a whole. In the present study, the mean age of the post graduate students was 27.04 years, while in a study done by Lakshmikantha et al (2016)^[10], the mean age of the population was 36.46 \pm 8.104 years.

In this present survey, 93.7% of the students said that they were aware of term BMWM, which is similar to the study done by Potlia I et al (2017)^[3], (91.7%) and in contrast to the studies done by EA Othigo (2008)^[11], and Soumya et al (2018)^[8], 41.9% and 22% respectively. In the present study, 99% of the participants were aware of colour coding of waste containers, which is in agreement to the study done by G V Usha et al (2016)^[7] and Potlia I et al (2017)^[3], where they found 87.9% and 98%

respectively. All the participants had complete knowledge (100%) about the clinical significance of labelling the containers. According to Biomedical Wastes (Management and Handling) Rules, 1998, stated that colour coding and labelling of the containers is mandatory. Comparable was the observation made by G V Usha et al (2016)^[7] where the participants had a relatively good level of knowledge (94%) about BMW management and transmission of infections like HIV/hepatitis.

In this study, 95.3% of the post graduate students had correct knowledge that waste should not be stored for more than 48hr, which is in contrast to the study done by Gonmei D et al (2016)^[12], where only 36% participants knew about the storage duration of BMW. No untreated biomedical waste should be stored beyond a period of 48 hours which is set by national authorities for infectious BMWS to be kept in hospital premises. 94.3% of the participants were aware that Pollution Control Board of India regulates safe transport of waste, which is contrary to the study done by G V Usha et al (2016)^[7], where only 54% of students were aware. This clearly shows that the study participants had very good knowledge regarding storage time limit and regulation of safe transport of waste. This difference might have arisen due to the involvement of postgraduate students with faculties from different branches, and also regular interaction with the biomedical waste management team about transport and disposal of the wastes. According to WHO fact sheet, approximately 20% of waste generated by various health-care units is reported to be hazardous.

94.7% participants in the present study had a positive attitude towards segregation of waste at sources increases the risk of injury to waste handlers. This result is in contrast to the study done by G V Usha et al (2016)^[7], where only 35% participants showed a positive attitude. This is because segregation prevents mixing of infectious with non-infectious waste, thus minimizing the high cost and care involved, and also it reduces the chance of accidental infection of health care workers and waste handlers. In the present study, 96.7% students said that infectious waste should be kept in yellow plastic bag with biohazard symbol, which is in agreement to the study done by Manchanda et al (2015)^[9], where 83% participants were having the same attitude. This implies that the study participants had a willing and motivated attitude for an effective BMW. According to BMW (Management and Handling Rules, 1998, Schedule I), all the substances sent to incinerator/burial, should be placed in yellow coloured bags, e.g., microbiological waste, human anatomical waste, and soiled plastic waste.

It was seen in the present study that, 96.3% of the post graduate students were aware that excess mercury should be stored in water/fixer, which is in contrast to the study done by G V Usha et al (2016)^[7], where this percentage was 35%. 96% of the participants in present study agreed for attending voluntary programs, which is line with the study done by Lakshmikantha et al (2016)^[10], with 84%. The results show that the post graduate students had positive attitude towards attending a voluntary program and they are willing to gain more and proper knowledge regarding BMW management.

97.7% of the subjects participated in the study had positive attitude towards the occupational safety of waste handlers, which is in line to the study done by Chudasama et al (2013)^[13], where the positive attitude was shown by 85% of the samples. It is reassuring to note that in the present study, all the participants were aware that decontamination reduces the chances of infection, which is in line to the study done by Manchanda et al (2015)^[9], which is 89%. The participants seem to have a bright outlook towards BMW management, to maintain a safe working environment both for themselves as well as for the waste handlers.

Since, the post graduate students are more regularly treating patients and also following all the guidelines of waste disposal, all the participants in the present study had positive attitude towards post exposure prophylaxis and about the protective clothing of waste handlers, which is similar to the study done by Manchanda et al (2015)^[9], where 88% of participants had positive attitude.

When asked about the disposal of exposed x-ray films, 66% of the participants stored it separately, which is similar to the study done by Sudhir et al (2006)^[11], but the films are generally harmless and can be considered as general waste and can be disposed directly into the common bin. 39% of the

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participants in this study, practiced destroying the needle with the needle burner, which is the ideal method. This in contrast to the study done by Indulekha V et al (2018)^[14], where they used puncture proof container to discard needles. It is important that, there should be a need of legislation to ensure the proper disposal of sharp wastes (needles and files).

In the present study, 46.7% of the participants deformed the orthodontic wires and brackets and then disposed it off, whereas in a study done by Sudhir et al(2016)^[11], participants store orthodontic wire and brackets separately and treated as recyclable waste. According to OSHA (Occupational Safety and Health Administration) regulations, orthodontic wires are considered as sharp waste because the ends of the orthodontic wires can penetrate the skin and their contamination with blood can reasonably be anticipated. So they should be disposed as sharp wastes and it should be categorized as recyclable waste. Only 68.4% of the students in the present study disposed outdated and contaminated medicines in secured landfill, which is the ideal method. This clearly shows that substantial participants (31.6%) have inadequate knowledge regarding disposal of outdated and contaminated medicines.

Greater number of the students (56%) in the present study, practiced storage of excess silver amalgam in an air tight container which is similar to the study done by Kulkarni et al, (2019).^[15] According to American Dental Association, fixer solution is the recommended method for storage of excess silver amalgam. While majority of the participants had a positive attitude towards disposing excess silver amalgam in a container with water/fixer, but while practicing, they were not following the proper method of disposal. This clearly indicates that even after being aware of the guidelines, the students were lacking in practice of biomedical waste management. There should be a proper training programs regarding awareness and practice of waste disposal for all healthcare staff, both post graduate as well as undergraduate students with continuous monitoring at regular intervals.

In the present study, 61.3% participants disposed the developer solution by diluting and led into sewer, as developer solution does not contain silver so it can be diluted and put into sewer. More than half of the post graduate students (68.4%) practiced final disposal of dental care waste by giving it to the certified collectors. This study is in line with the study done by G.V.Usha et al (2016)^[7].

In the present study, when association was done between knowledge and gender, regarding safe transport of health care wastes by Pollution Control Board, the results were found to be statistically significant as the knowledge was found more in females as compared to males. ($p < 0.001$)

When association was assessed between attitude and gender, the results came to be statistically significant between males & females regarding “segregation of waste increases risk of injury to waste holders”, ($p = 0.007$), and “excess mercury should be stored in water/fixer” ($p = 0.013$) and “would like to attend voluntary programs” ($p = 0.021$).

When association was done between practice and gender, the results came out to be statistically significant between males & females regarding ‘storage of excess silver amalgam’ ($p = 0.003$), ‘disposal of orthodontic wires and brackets’ ($p = 0.004$) and ‘How do you dispose developer solution in your clinic/department’ ($p = 0.016$).

Recommendations

1. The local dental associations and government authorities should conduct a biomedical waste management programs regularly for all the dental students.
2. Training and workshops are required to have a coherence of biomedical waste management in all the dental institutes.
3. Proper health education should be given to all students as it plays a decisive role in making the future health professionals aware of safe practices in biomedical waste management.

Conclusion

From the present study, it can be concluded that the post graduate students had fair to good knowledge and attitude for improvement and also shows a positive outlook towards BMW. A large

number of practitioners were aware of different categories and colour coding of different types of waste yet have failed to practice the same in their daily routine. Adequate knowledge and attitude coupled with proper practice of the dental professionals can cut down the risk and hazard of biomedical wastes.

Table – 1: Distribution of Respondents according to Knowledge Towards Biomedical Waste Management

Knowledge Towards Biomedical Waste Management	No		Yes	
	No.	%	No.	%
Aware of the term 'biomedical waste'	19	6.3	281	93.7
'Biomedical waste rules applicable for dentists	6	2.0	294	98.0
Aware of colour coding	3	1.0	297	99.0
Discard the used needle immediately	0	0.0	300	100.0
Biomedical waste transmits the infectious diseases	17	5.7	283	94.3
Clinical significance of labelling container	0	0.0	300	100.0
Pollution control board of India regulates healthcare waste transport	17	5.7	283	94.3
Waste should not be stored more than 48 hrs	14	4.7	286	95.3

Table – 2: Distribution of Respondents according to Attitude Towards Biomedical Waste Management

Attitude Towards Biomedical Waste Management	No		Yes	
	No.	%	No.	%
Segregation of waste increases risk of injury	16	5.3	284	94.7
Infectious waste should be put in yellow plastic	10	3.3	290	96.7
Excess mercury should be stored in water	11	3.7	289	96.3
Would like to attend voluntary programs	12	4.0	288	96.0
Occupation safety of waste handlers is must	7	2.3	293	97.7
Decontamination reduces the chances of infection	0	0.0	300	100.0
Post exposure prophylaxis should be stored ASAP	0	0.0	300	100.0
Waste handler should use protective clothing	0	0.0	300	100.0

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Table – 3: Distribution of Respondents according to Correct Practice Towards Biomedical Waste Management

Practice Towards Biomedical Waste Management	No.	%
Do you use personal protective devices	300	100.0
Disposal of exposed X-ray film	102	34.0
Disposal of infectious sharp waste like needle or files	117	39.0
Storage of excess silver amalgam	42	14.0
Disposal of orthodontic wires and brackets	140	46.7
Disposal of outdated and contaminated medicines	205	68.4
How do you dispose developer solution in your clinic/department	184	61.3
Final disposal of dental care waste	205	68.4

Table – 4 : Association of Gender with Knowledge Towards Biomedical Waste Management

Knowledge Towards Biomedical Waste Management		Male		Female		chi sq	p-value
		No.	%	No.	%		
Pollution Control Board of India regulates healthcare waste transport	No	14	15.6%	3	1.4%	23.52	<0.001
	Yes	76	84.4%	207	98.6%		

Table – 5 : Association of Gender with Attitude Towards Biomedical Waste Management

Attitude Towards Biomedical Waste Management		Male		Female		chi sq	p-value
		No.	%	No.	%		
Segregation of waste increases risk of injury to waste holders	No	0	0.0%	16	7.6%	7.24	0.007
	Yes	90	100.0%	194	92.4%		
Excess mercury should be stored in water/fixer	No	7	7.8%	4	1.9%	6.15	0.013
	Yes	83	92.2%	206	98.1%		
Would like to attend voluntary programs	No	0	0.0%	12	5.7%	5.36	0.021
	Yes	90	100.0%	198	94.3%		

Table – 6: Association of Gender with Practice Towards Biomedical Waste Management

Practice Towards Biomedical Waste Management		Male		Female		chi sq	p-value
		No.	%	No.	%		
storage of excess silver amalgam	A	7	7.8%	33	15.7%	13.80	0.003
	B	65	72.2%	103	49.0%		
	C	10	11.1%	40	19.0%		
	D	8	8.9%	34	16.2%		
disposal of orthodontic wires	A	4	4.4%	4	1.9%	13.41	0.004
	B	49	54.4%	91	43.3%		

and brackets	C	8	8.9%	6	2.9%		
	D	29	32.2%	109	51.9%		
How do you dispose developer solution in your clinic/department	A	13	14.4%	17	8.1%	10.30	0.016
	B	43	47.8%	141	67.1%		
	C	3	3.3%	6	2.9%		
	D	31	34.4%	46	21.9%		

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