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Knowledge, Attitude, and Practice about Dental Waste Management among Dental Practitioners in Ghaziabad - A Questionnaire Based Cross-Sectional Study

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Abstract

Introduction: The increased accessibility of healthcare facilities has not only significantly improved quality of life of population but also threatens the community health due to production of tremendous amount of biomedical waste at an alarming rate. According to the estimations by US medical waste tracking System, Dentists generates approximately 3% of total medical waste that can be detrimental to the environment if not properly managed.

Aim: The present study aims to assess the knowledge, attitude, and practices of dental waste management among dental practitioners in Ghaziabad.

Methodology: A questionnaire based cross-sectional study was conducted among 243 dental practitioners in Ghaziabad during the month of January 2020. A pre-validated, close-ended questionnaire was used to collect the data. The knowledge, attitude and practice of dental waste management among graduate and post-graduate dental practitioners were assessed using Chi square analysis and p value ≤ 0.05 was considered statistically significant.

Results: The response rate was 85.1% (Of 243 private dental practitioners, 207 dentists completed the entire questionnaire). 85.5% and 74.9% of dentists were aware

of biomedical waste management legislation and about the local dental waste management agency, respectively. All of the dentists in our study considered improper dental waste management to be hazardous for health while 87.9% of dentists considered segregation of dental waste from general waste to be essential. The overall knowledge, attitude and practice of dental waste management was observed to be improved among post graduate dentists when compared with the undergraduate dentists.

Conclusion: The findings of this study can be concluded that dentists of Ghaziabad have knowledge about the management of dental waste but there is laxity in execution of correct practices. A "team up approach" by government, dentists and auxiliaries is essential to completely solve the issue of improper medical or dental waste disposal.

Keywords: Attitude, Biomedical waste management, Dental waste management, Dentists, Knowledge, Practice

Introduction

Health care industry is one of the leading industries globally and currently, with the civilization and advancement in the medical technology, a greater population is having access to health services than before. [1, 2] This increased accessibility of healthcare facilities has not only significantly improved quality of life of population but also threatens the community health due to production of tremendous amount of biomedical waste at an alarming rate. [2, 3]

The medical waste generated in India is around 3 million tons per annum out of which about 10 to 35 % of medical waste generated is potentially hazardous, but owing to indiscriminate mixing of this with non-hazardous waste converts entirety waste hazardous (Begum A et al., 2015; Chaudhari K et al. 2015; Kaur D et al., 2015). [4] Karnataka is the largest bio-waste producer followed by Maharashtra being the second position and Kerala being the third highest bio-waste producer of India. [5] An alarming fact is that along with an increase in the number of hospitals and their inherited Biomedical Waste (BMW), a huge bulk of it is even dumped unprocessed. [6, 7]

The term biomedical waste has been defined as "any waste that is generated during the diagnosis, treatment, or immunization of human beings or animals, or in the research activities pertaining to or in the production or testing of biological and includes categories mentioned in schedule I of the Biomedical Waste (Management and Handling) rules 1998". [8, 9] Biomedical waste (BMW) includes "waste generated during diagnosis, treatment or immunization of human beings or animals, or in research activities pertaining thereto, or in the production or testing of biologicals, and is contaminated with human fluids". [10, 11] The WHO estimates that 85% of hospital waste is nonhazardous; around 10% is infectious, while the remaining 5% is non-infectious. [12]

Improper waste disposal has led to numerous health hazards such as injuries from sharps, development of nosocomial infections in patients particularly human immunodeficiency virus (HIV), Hepatitis B and C, and emergence of resistant strains of microorganisms. [1] Also, this waste disposed of before suitable treatment, can affect environment rendering air, land and water bodies' contaminated. [4]

Dental office is also a source of generation of biomedical waste that can be detrimental to the environment if not properly managed. [9, 13] According to the estimations by US medical waste tracking System, Dentists generates approximately 3% of total medical waste. [14] Dental waste is classified into two categories: liquid dental waste and solid dental waste, which are further categorized into infectious waste and hazardous waste. The infectious waste contains blood saturated materials and pathologic tissues such as extracted teeth. Conversely, hazardous

waste comprises metals that are toxic and long lasting within the environment, which do not undergo degradation. It consists of silver, lead, mercury, X-rays and cleaning solutions. [15, 16] Amalgam, an acute neurotoxin, is a major concern in the dental field. [15, 16] If the manipulation of amalgam and its waste products are not strictly regulated, it could be responsible for environmental pollution as well as occupational exposure and also leads to certain bacterial as well as viral infections such as HBV, HIV and toxicities. [2, 17]

In the last few years there has been rapid mushrooming of dental health care set ups catering the needs of people which in turn leads to definite increase in the quantity of biomedical waste generated. [16, 18] Unfortunately, reports suggest that almost 80% of medical/dental waste are mixed with general waste, thereby rendering the general waste also toxic and hazardous. [18,19] Even though there is increased global awareness among health care professionals about threats and also suitable waste management techniques, in India, most dentists and dental hospitals are not actively involved in addressing this problem. [18, 20] Keeping in view the above scenario, the present study has been undertaken to assess the level of knowledge, attitude, and practices of dental waste management among dentists in Ghaziabad, thereby enabling formulation of strategies for adequate dental waste management and disposal by dentists in the near future.

Objectives

1. To assess the knowledge, attitude, and practices of dental waste management among dental practitioners in Ghaziabad.
2. Discuss the best possible strategies for adequate dental waste management in relation to the findings of survey.

Methodology

A questionnaire based cross-sectional study was conducted during the month of January 2020. The reference population comprised of randomly selected 500 private dental practitioners of Ghaziabad district in Uttar Pradesh. The selected participants were contacted through phone and then the data was collected through e-mail. About 243 dentists consented to participate in the study. Only private dental practitioners practicing in Ghaziabad city who consented to participate were included in the study. Confidentiality of participants was strictly maintained. Ethical clearance was obtained from the Institutional Review Board.

A pre-validated, close-ended questionnaire was used to collect the data. It comprised four domains – Demographic data, Knowledge, Attitude, and Practice, respectively. The study was pretested on 25 participants who were also requested to report any questions which they could not understand. Cronbach's alpha value was enabled to measure the internal consistency of the questionnaire and the values were found to be 0.79, 0.84, and 0.87 for the knowledge, attitude, and practice sections, respectively.

Statistical Analysis

The data were compiled and tabulated in Microsoft Excel spreadsheet and were subjected to frequency distribution analysis using the Statistical Package for the Social Sciences software (SPSS) 21.0 (SPSS Inc., Chicago, IL, USA). The knowledge, attitude and practice of dental waste management among graduate and post-graduate dental practitioners were assessed using Chi square analysis and p value ≤ 0.05 was considered statistically significant.

Results

Table 1: Demographic data of the Dental Practitioners

Demographic Data		Number	Percentage
Age	< 30 years	35	16.9%
	30-40 years	116	56%
	> 40 years	56	27.1%
Gender	Male	169	81.6%
	Female	38	18.4%
Educational Qualification	BDS	112	54.1%
	MDS	95	45.9%

Table 2: Knowledge of Dental Waste Management among Dental Practitioners according to their Educational Qualification (Chi square)

Knowledge		BDS	MDS	Total	P Value
1. Are you aware of BMW management legislation in India?	Yes	88 (42.5%)	89 (43%)	177 (85.5%)	0.002**
	No	24 (11.6%)	6 (2.9%)	30 (14.5%)	
2. Do you know the agency responsible for dental waste management in your city?	Yes	71 (34.3%)	84 (40.6%)	155 (74.9%)	0.001**
	No	41 (19.8%)	11 (5.3%)	52 (25.1%)	
3. Safe management of dental waste is the duty of?	Only Government	19 (9.2%)	2 (1%)	21 (10.2%)	0.001**
	Teamwork of Government, Dental surgeons and Auxiliaries	93 (44.9%)	93 (44.9%)	186 (89.8%)	
4. Sharps (such as broken needles, surgical blades, and burs) should be disposed in?	Yellow bag	3 (1.4%)	5 (2.5%)	8 (3.9%)	0.009**
	Red bag	27 (13%)	8 (3.9%)	35 (16.9%)	
	White translucent puncture-pro of containers	82 (39.6%)	82 (39.6%)	164 (79.2%)	
	Do not know	0	0	0	
5. Expired medicines belong to which category?	Chemical waste	65 (31.4%)	84 (40.6%)	149 (72%)	0.001**

	Cytotoxic waste	43 (20.8%)	9 (4.3%)	52 (25.1%)	
	Biotechnological waste	0	0	0	
	Do not know	4 (1.9%)	2 (1%)	6 (2.9%)	
6. Impression materials and infected cotton are included in which category?	Solid waste	6 (2.9%)	2 (1%)	8(3.9%)	0.001**
	Soiled waste	19 (9.2%)	6 (2.9%)	25 (12.1%)	
	Infected waste	67 (32.4%)	83 (40.1%)	150 (72.5%)	
	Do not know	20(9.6%)	4 (1.9%)	24(11.5%)	

Table 3: Attitude of Dental Practitioners towards Dental Waste Management according to their Educational Qualification (Chi square)

Attitude		BDS	MDS	Total	P Value
1. Do you think it is important to segregate dental waste from general waste?	Yes	92 (44.4%)	90 (43.5%)	182 (87.9%)	0.006**
	Yes	20 (9.7%)	5 (2.4%)	25 (12.1%)	
2. Will you be interested to attend voluntary programs that enhance and upgrade your knowledge about waste management?	Yes	73 (35.3%)	77 (37.2%)	150 (72.5%)	0.011**
	No	39 (18.8%)	18 (8.7%)	57 (27.5%)	
3. Do you think safe management of dental waste is an extra burden on work?	Yes	26 (12.6%)	21(10.1%)	47 (22.7%)	0.188
	No	20 (9.7%)	9 (4.3%)	29 (14%)	
	No comments	66 (31.9%)	65(31.4%)	131 (63.3%)	
4. Do you think infectious waste should be sterilized from infections by autoclaving before shredding and disposal?	Yes	53(25.6%)	63(30.4%)	116(56%)	0.001**
	No	43(20.77%)	10 (4.83%)	53(25.6%)	
	Do not know	16 (7.8%)	22 (10.6%)	38 (18.4%)	
5. Do you think improper waste management can be hazardous to health?	Yes	112(54.1%)	95 (45.9%)	207 (100%)	-
	No	0	0	0	

Table 4: Practice of Dental Waste Management among Dental Practitioners according to their Educational Qualification (Chi square)

Practice		BDS	MDS	Total	P Value
1. Do you segregate waste before disposal?	Yes	75 (36.2%)	79 (38.2%)	154(74.4%)	0.018**
	No	15(7.3%)	9(4.3%)	24 (11.6%)	
	Sometimes	22(10.6%)	7(3.4%)	29(14%)	
2. Do you follow color coding of waste?	Yes	68(32.8%)	79(38.2%)	147(71%)	0.001**
	No	25(12.1%)	6(2.9%)	31(15%)	
	Sometimes	19(9.2%)	10(4.8%)	29(14%)	
3. Are you registered with a certified waste carrier service to dispose BMW of your clinic?	Yes	86(41.5%)	85(41.1%)	171(82.6%)	0.016**
	No	26(12.6%)	10(4.8%)	36(17.4%)	
4. How do you dispose an infected needle?	Common bin	34(16.4%)	13(6.3%)	47(22.7%)	0.004**
	Burn and dispose	78(37.7%)	82(39.6%)	160(77.3%)	
5. How do you dispose used fixer solution?	Directly in basin and sewer	19(9.2%)	33(15.9%)	52(25.1%)	0.006**
	Handover for offsite disposal to a certified agency	50(24.2%)	40(19.3%)	90(43.5%)	
	Do not use solution	43(20.8%)	22(10.6%)	65(31.4%)	
6. How do you dispose X-ray film lead foils?	Common bin	19(9.2%)	33(15.9%)	52(25.1%)	0.006**
	Handover for offsite disposal to a certified agency	50(24.2%)	40(19.3%)	90(43.5%)	
	Do not use	43(20.8%)	22(10.6%)	65(31.4%)	
7. How do you dispose excess leftover silver amalgam?	Common bin	0	0	0	0.962
	Store in fixer solution	29(14%)	23(11.1%)	52(25.1%)	
	Store in	22(10.6%)	19(9.2%)	41(19.8%)	

	container with water				
	Do not use	61(29.5%)	53(25.6%)	114(55.1%)	
8. How do you dispose extracted teeth?	Common bin	16(7.8%)	12(5.8%)	28(13.6%)	0.916
	Yellow bag	89(43%)	76(36.7%)	165(79.7%)	
	Red bag	2(1%)	3(1.4%)	5(2.4%)	
	None of the above	5(2.4%)	4(1.9%)	9(4.3%)	

The study questionnaire was distributed among 243 private dental practitioners among which 207 dentists responded to it and completed the entire questionnaire. The response rate was 85.1%.

Of the participating dentists in the present study, 81.6% were male and 18.4% were female with maximum (56%) of dentists being aged 30-40 years, 16.9% aged < 30 years and 27.1% >40 years of age. Postgraduation was completed by 45.9% of dentists while 54.1% were graduates [Table 1].

The knowledge of Dental Waste Management among Dental Practitioners according to their educational qualification is shown in Table 2. 85.5% and 74.9% of dentists were aware of biomedical waste management legislation and about the local dental waste management agency, respectively. Safe disposal of waste was considered to be a team effort by 89.8% of dentists. 79.2% of dentists correctly answered about the disposal of sharps (such as broken needles, surgical blades, and burs) in white translucent puncture proof containers. Proper knowledge about the cytotoxic category for expired medicines and soiled waste category for impression materials and infected cotton was known by only 25.1% and 12.1%, respectively. While comparing the graduate and post-graduate dental practitioners, a significant increase in knowledge regarding Dental waste management was found among the post-graduate dental practitioners and the difference was statistically significant ($p \leq 0.05$).

Attitude of the Dental Practitioners towards Dental Waste Management according to their educational qualification is shown in Table 3. Segregation of dental waste from general waste was considered to be essential by 87.9% of dentists. 72.5% of dentists were interested in attending voluntary programs on waste management and 22.7% of dentists answered safe management of dental waste to be an extra burden on work. All of the dentists in our study considered improper dental waste management to be hazardous for health but only 56% of dentists considered autoclaving of infectious waste before disposal as essential. While analyzing the attitude of dental practitioners, the postgraduates were observed to have a more positive attitude towards dental waste management and the difference was statistically significant ($p \leq 0.05$).

The practice of Dental Waste Management among Dental Practitioners according to their educational qualification is shown in Table 4. 74.4% and 71% of respondents segregated waste before disposal and color coded the waste, respectively. 82.6% of dentists had registered their clinic with the biomedical waste disposal service provider. 77.3% of dentists burnt and disposed the needles while only 43.5% reported the correct disposal of both fixer and X-ray film lead foils. Excess and leftover silver amalgam was reported to be stored in fixer by 25.1% of the dentists.

Extracted teeth were correctly disposed in yellow bags by 79.7% of the dentists. Most of the postgraduate dentists correctly managed the dental waste than the graduate dentists and the difference was statistically significant for most of the practice related questions ($p \leq 0.05$).

Discussion

Dental practices generates considerable amount of biomedical waste which can be hazardous to the environment, as well as to those who come in contact with these materials, if not dealt with appropriately. [1] Lacking the knowledge of dentists regarding management and possible hazards of biomedical waste can affect general health status as well as the environment. [8] Hence, this study was conducted to assess the knowledge, attitude, and practices of dental practitioners in Ghaziabad regarding dental waste management.

In the present study about 85.5% of the dental practitioners were aware of biomedical waste management legislation in India and the study result shows agreement with the study conducted by Jamkhande A et al (2017) in which 94.6% of the dentists in Pune were aware of the same. [5] In the studies conducted by Gupta NK et al (2016) and Anand P et al (2016), 93.3% medical officers and 70.8% doctors respectively were aware of the BMW management rules. [7, 10] According to the present study, 74.9% of dentists were aware of the local dental waste management agency in their city and the results showed agreement with the study done by Jamkhande A et al (2017) in which 85.7% of the dentists were aware of the same. [5] About 79.6% of the participants in a study by Lakshmikantha R et al (2016) was aware of the dental waste management agency present in their area. [21] 89.8% of dentists in our study was aware that safe disposal of waste is the teamwork of government, dental surgeons and auxiliaries and this result is in agreement with the studies by Jamkhande A et al (2017) and Khandelwal V et al (2013) in which 92.8% and 92% of the participants respectively believed the same. [5, 22]

79.2% of the present study participants correctly answered that sharps such as broken needles, surgical blades, and burs should be disposed in white translucent puncture proof containers. This result shows agreement with the studies done at Pune by Jamkhande A et al (2017) and Khatri M et al (2014) in which 72.3% and 61% of the dentists respectively was aware of the proper disposal of sharp dental wastes. [5, 23] In a study by Gupta NK et al (2016), 80% of the medical officers was aware about the proper discarding method of needles. [7] Only 25.1% of the dentists in our study was aware that expired medicines belongs to cytotoxic waste category and the results shows agreement with the studies by Puri S et al (2019), Jamkhande A et al (2017) and Bansal et al (2013) in which 11.3%, 23.2% and 24% of the dentists respectively were aware of the same. [5, 12, 16] The soiled waste category for impression materials and infected cotton was known by only 12.1% of the present study participants and in the study by Puri S et al (2019) 31.2% of the dentists were aware of the same. [12] The smaller percentage of dentists awareness about proper disposal of expired medicines, impression materials and infected cotton signifies that the knowledge among dentists about categorization of wastes was considerably less and measures need to be initiated toward it.

Regarding the importance of segregating dental wastes from general wastes, 87.9% of the dentists in our study showed a positive attitude and this shows agreement with the study by Jamkhande A et al (2017) in which 94.6% of the dentists believed the same. [5] In a study by Pawar PA et al (2017) 79.2% of the respondents believed that it is necessary to collect biomedical waste in separate color coded bags or containers. [17] In the present study, 72.5% of dentists showed their interest in attending voluntary

programs on waste management and this result showed agreement with the studies by Jamkhande A et al (2017) and Pawar PA et al (2017) in which 96% and 95.8% of the dentists respectively showed their willingness to attend such programs. [5, 17] According to a study by Anand P et al (2016) conducted among the health care personnel in a teaching institution, all the doctors and lab technicians wanted to upgrade their knowledge on biomedical waste management while 75% of class IV employees wanted to learn more about biomedical waste management. [10] 22.7% of dentists in our study answered safe management of dental waste is an extra burden on their work. Almost similar result was showed by the studies of Jamkhande A et al (2017) and Anand P et al (2016) in which 30.4% of dentists and 37.5% of the doctors respectively responded the same. [5,10]

As per the revised rules of Biomedical waste management (2016) by WHO or National AIDS Control Organization guidelines, additional importance has been given to pre-treatment of Biomedical waste before disposal to prevent microbial contamination. [24] However, only 56% of the dentists in our study considered it to be important and the result showed similarity with the studies by Jamkhande A et al (2017) and Lakshmikantha R et al (2016) in which 52.7% and 59.1% of the participants respectively responded the same. [5, 21] Regarding the consideration of improper dental waste management to be hazardous for health, a 100% response rate of dentists was obtained in our study and the similar results was observed in the studies of Jamkhande A et al (2017) and Narang et al (2012). [5, 25] Thus the study showed a positive attitude of dental practitioners towards following and upgrading themselves about proper dental waste management.

Regarding the practice of dental waste management, 74.4% and 71% of dentists in our study claimed that they segregated waste before disposal and color coded the waste, respectively. The results are in agreement with the study by Jamkhande A et al (2017) in which 73.3% and 79.5% of dentists respectively practiced the same. [5] The study by Anand P et al (2016) reported that 83.3% of the doctors color coded the waste before disposal while the study by Pawar PA et al (2017) reported that 93.8% of the dentists segregated waste before disposal. [10, 17] 82.6% dentists in the present study had registered their clinic with a certified waste carrier service to dispose biomedical waste and this shows agreement with the study by Jamkhande A et al (2017) in which 81.2% of the respondents did the same. [5]

77.3% of dentists in this study burnt and disposed the used needles similar to the study by Jamkhande A et al (2017) in which 71.4% of the dentists used the same method. [5] In the study by Pawar PA et al (2017), 27.1% dentists disposed the used needles in needle burn while 31.2% dentists broke needle and dispose in common bin. [17] In our study, 43.5% of the dentists handover both fixer and X-ray film lead foils for offsite disposal to a certified agency. The results showed similarity with the study by Jamkhande A et al (2017) in which 42% and 43.8% of the dentists respectively disposed the used fixer and X-ray film lead foils in the correct manner. [5] In a study by Shaikh et al (2018), 46% dentists collect lead foils and dispose it to local waste collection body whereas 38% dentists dispose the fixer solution offsite, considering it as a hazardous waste. [13] The American Dental Association recommends storage of amalgam in “photographic fixer” in a closed container before disposing to prevent health hazards. [1] But in our study, excess and leftover silver amalgam was reported to be stored in fixer by only 25.1% of the dentists and this result showed agreement with the studies by Bansal et al (2013)[16], Pawar PA et al (2017) [17] and Jamkhande A et al (2017) [5] in which 10%, 12.5% and 22.3% dentists respectively, practised the proper

method for excess silver amalgam disposal. 79.7% of the dentists in our study disposed extracted teeth in yellow bags and this result showed agreement with the studies by Bansal et al (2013) [16] and Jamkhande A et al (2017) [5] in which 62% and 70.5% of the dental practitioners respectively used the yellow bag for the same.

While comparing the graduated and post graduated dentists of our study, it was seen that post graduated dentists had a significantly better knowledge, more positive attitude and improved practise of dental waste management. In a study by Puri S et al (2019), the mean knowledge score regarding dental waste management was significantly higher among postgraduate students when compared to interns. [12]

Limitations of a study should be taken into account when considering their findings. Generalizability of the results possibly will be one of the limitation of our study due to the smaller sample size. It is a fact that studies involving the use of questionnaires are susceptible to acquiescence bias and social desirability bias and this may also remain as another limitation.

By considering the knowledge, attitude and practice percentages of the present study regarding dental waste management, it can be inferred that even though dentists of Ghaziabad practice biomedical waste management rules there is still a need of provided guidance, information, and motivation to follow the proper rules more regularly.

Conclusion

The findings of this study can be concluded that dentists of Ghaziabad have knowledge about the management of dental waste but there is laxity in execution of correct practices. A “team up approach” by government, dentists and auxiliaries is essential to completely solve the issue of improper medical or dental waste disposal. There is a definite need to enforce more strict laws and measures for disposal in India, so that it becomes mandatory for all private practitioners to register their clinics under bio medical waste management services. Apart from that, quality assessment for management of biomedical waste at centers should be routinely done from time to time.

Safe and effective management of waste is not only legal necessity but also a social responsibility. It is imperative that waste should be segregated and disposed-off in a safe manner to protect the environment as well as human health and for this an optimistic attitude and collective accountability of all health care workers are required. Periodic and orientation based training programmes should be provided to all health care workers, so that both the knowledge as well as practice of bio-medical waste management can be upgraded. Even though the topic of biomedical waste management is included in the curriculum, there should be an essential need for better education with practical demonstration classes to further improve the knowledge of biomedical waste management by well-designed seminars, programs, workshops, assessments etc and also there is an urgent need for continuing dental education on dental waste management practices to all the dental practitioners. The concept of “habits die hard” can help to an extent in making the dental students habituated from incipient stage by their teachers to abide by these rules in educational institutions by assigning them duties of waste segregation and color coding.

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