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Assessment of Infection Control Measures and Bio-Medical Waste Management Practices among the Private Dental Practitioners of Ahmadabad city: A cross-sectional study

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ABSTRACT

To investigate the knowledge, attitudes, and behavior of the private dental practitioners working in dental clinics regarding biomedical waste management and infection control measures. An online cross-sectional survey was conducted amongst private practitioners of Ahmedabad city. 18 questions were divided into 3 divisions to evaluate current bio-medical waste management practices and infection control measures amongst private dental practitioners. Values obtained from the survey were categorized according to qualification and years of experience. Chi-square test was used to statistically analyze data. A total of 223 Mean age 30.2 years, SD 8.6 years dentists responded, giving a response rate of 60.27%. Less-experienced practitioners and practitioners with higher qualifications showed better responses when compared to other groups regarding the type of gloves, use of wrapping bag, method of alginate impression disinfection, preferred time for using wrapped sterilized instruments as well as disposal of X-ray film, excised soft tissues, and used plastic items and sharps. Privatedental practitioners with postgraduate degrees and less experienced private dental practitioners showed better infection control and waste management practices compared to graduate and more experienced private practitioners respectively. There was a statistically significant difference in the responses of the above-mentioned categories.

Keywords: Cross infection, dentist, infection control, waste management

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INTRODUCTION

Dental clinics are the source of toxic waste, which can be infectious, it can be a chemical or pharmaceutical waste. [1] Recent Covid-19 pandemic has underlined the importance of infection control in dental practice. [2]The goal of infection control is to provide a safe working environment for dental health care personnel and their patients by preventing disease transmission through direct and indirect contact, which can be achieved by adopting measures that reduce healthcare-associated infections. [3]

Bio-Medical Waste is a waste generated during diagnosis, treatment, or immunization of human beings or research activity. [4]It includes various materials like soaked cotton, sharp needles, extracted teeth, human tissue parts, and so forth, which are usually contaminated with body fluids like blood and saliva which need to be discarded properly. [5]

Chaudhari *et al*. [6] conducted a study among dentists regarding bio-medical waste management, results showed that most practitioners were having adequate knowledge regarding biomedical waste management, whereas their attitude towards the same was found a little low[6]. Agarwal *et al*. [7] conducted among 320 dental professionals observed that the majority of dentists 86.15% routinely used disposable gloves & facemasks. 68.46% of the respondents used Impervious gowns. [7]Narang *et al*.

concluded that there is a lack of knowledge of most aspects of biomedical waste management among dental auxiliary staff at Amritsar dental hospital/clinics and a lack of awareness among dentists. [8]
A limited number of studies have been done regarding infection control measures or biomedical waste management among the private dental practitioners of Ahmedabad city, also representing dental practitioners of Gujarat; therefore, keeping this in mind, the objective of the study was to assess the current scenario regarding the practices of infection control and biomedical waste management among the private dental practitioners of Ahmedabad city.

MATERIAL AND METHODS

STUDY DESIGN:

A cross-sectional design of the study enrolled the private dental practitioners of Ahmedabad aged 23 and above years of both genders, practicing at their dental clinics. The exclusion criteria included non-practitioners, consulting practitioners, and assistant dentists. An online questionnaire using Google Forms was used to collect the data. Private dental practitioners were randomly selected from the Facebook group. Each participant was contacted individually to ensure that he/she was a practicing dentist and owned a private dental clinic. The questionnaire was anonymous to take care of the privacy and confidentiality of all information collected within the study. Informed consent via an online Google form was obtained from all private dental practitioners. The study was conducted during the 1st and 2nd weeks of Aug 2021.

A validated, confidential closed-ended **interviewing questionnaire** was used. The survey was a structured 18 multiple-choice questionnaire designed to record all the relevant data about the dental practitioners' general information and practices regarding infection control and dental waste management in a private clinic. The questionnaire was in English and was based on the Guidelines for Infection Control in Dental Health Care Settings of the US Centers for Disease Control and Prevention and the guidelines of The Ministry of Environment and Forests of Government of India for biomedical waste management.

The questionnaire design: The questionnaire was divided into two parts.
The first part of the questionnaire consisted of 3 questions on socio-demographic variables which helped us to categorize the private dental practitioners. The second part of the questionnaire consisted of 15 questions on infection control measure 8 questions and dental waste management practices 7 questions in a private clinic.

Private dental practitioners self-reported practices: Private dental practitioners were asked 15 questions out of which 5 questions were regarding the sterilization method of dental equipment, 5 questions were regarding color coding of a waste bin for waste management and 5 questions were regarding the methods of cross infection prevention. Questions were asked to find self-reported practices in a private dental clinic. These questions were regarding the type of gloves, disinfection procedure for different dental equipment, and color coding for a different type of dental waste.
Dentists have an ethical responsibility to the environment and themselves. Because of the nature of their profession, dentists and dental assistants should not forget that they are at risk for treating patients who may have infectious diseases. [9]

Statistical analysis

Data collected from the questionnaire were analyzed by statistical software SPSS 20.0 [SPSS IBM, Chicago, US], Frequencies, and percentages were calculated for all questions concerned. The data were statistically analyzed using the chi-square test. A chi-square test for independence compares two variables in a contingency table to see if they are related. In a more general sense, it tests to see whether distributions of categorical variables differ from each other.

RESULT

The questionnaire was submitted to 400 private dental practitioners, out of which 223 private practitioners participated, corresponding to a response rate of 60.27%. 84 dentists [37.7%] were postgraduate practitioners, 139 [62.3%] were graduate practitioners. The maximum number of respondents belonged to 22 to 30 years 70%. 50.2% of Practitioners had experience of 6 to 10 years of working in their clinic. 49.2% of practitioners had the experience of below 5 years. [Table 1]

Table 1: Sociodemographic and professional distribution

Categories	Variables	N	%
1. Educational background	BDS	139	62.30%
	MDS	84	37.70%
2. Duration of practice	< 1 year	59	26.50%
	1- 5 years	112	50.20%
	5- 10 years	24	10.80%
	More than ten years	28	12.60%

values are present as- N: Number of participants; %: Percentage of participants

Almost all private dental practitioners reported that they prefer autoclaves to sterilize instruments in their clinics. A disinfectant solution is the most preferred method reported by private dental practitioners for the sterilization of hand pieces. Washing under running water 48.4% was the most commonly followed method for disinfection of alginate impression. The majority 77.1% of the practitioners used a plastic bag to pack impressions and cast. 49.32% of private dental practitioners wore latex examination gloves while treating their patients. Contrary to general awareness, 19.7% of the practitioners were not aware of the assistant staff's immunization. [Fig.1]

Questions	Options	N	%
1. Which type of gloves do you use most commonly during the dental procedure?	a) Latex – Examination Gloves	109	48.90%
	b)Latex – Surgical Gloves	57	25.60%
	c) Nitrile	56	25.10%
	d)Vinyl	1	0.40%
2. Which of the following sterilization methods do you use in the dental clinic?	a) Autoclave	216	96.90%
	b)Boiling water	2	0.90%
	c)Disinfectant solutions	3	1.30%
	d) Hot air oven	2	0.90%
	e)Autoclave	1	0.40%
3. How frequently do you sterilize instruments in the dental clinic?	a)In between patients	50	22.40%
	b) Once a day	85	38.10%
	c) Twice a day	87	39.00%
	d) In between patients	27	12.10%
4. How do you dispose of hazardous waste such as needles, blades, and ampoules?	a) Yellow bag	31	13.90%
	b)Red bag	72	32.30%
	c)Puncture-proof container	72	32.30%
	d)Plastic bottles	21	9.40%
5. Do you use wrapping bags for instrument sterilization?	e)Always	109	48.90%
	b)For diagnostic instruments only	16	7.20%
	c)I Use green cloth for wrapping	82	36.80%
	d)Occasionally	16	7.20%
6. What is the Preferred time for the use of sterilized and wrapped instruments in your clinic?	a)1 week	67	30.00%
	b)10 days	3	1.30%
	c)2 weeks	3	1.30%
	d)24 hrs	150	67.30%
7. How many times do you sterilize the dental handpiece?	a)In between patients	119	53.40%
	b)Once a day	87	39.00%
	c)Once a week	17	7.60%
8. How do you sterilize dental handpieces?	a)2% chlorhexidine	20	9.00%
	b)Autoclave	67	30.00%
	c)Boiling water	3	1.30%
	d)Surface disinfectant	133	59.60%
9. How do you disinfect the Alginate impression?	a)Immersion technique	35	15.70%
	b)Spray technique	80	35.90%
	c)Washing under running water	108	48.40%
10. How do you pack impressions or casts for transit to and from the laboratory?	a)Plastic bag	172	77.10%
	b)Special container	37	16.60%
	c)Wrap in tissue paper	18	8.10%
11. Where do you dispose of the human anatomical waste such as extracted teeth and excised soft tissue?	a)Common bin	107	48.00%
	b)Red coded bin	98	43.90%
	c)Yellow coded bin	54	24.20%
12. In your dental clinic, waste is not stored beyond.	a)1 week	15	6.70%
	b)12 hrs	44	19.70%
	c)24 hrs	65	29.10%
	d)48 hrs	32	14.30%
13. How would you dispose of X-ray film lead foils?	a)Common bin	135	60.50%
	b)Separate container	56	25.10%
	c)Yellow bag	51	22.90%
14. Does all the staff in your clinic has done the immunization of hepatitis B?	a)Have suggested.	22	9.90%
	b)No	44	19.70%
	c)Not aware	106	47.50%
	d)Yes	131	58.70%
15. How do you dispose of used plastic items?	a)Common bin	44	19.70%
	b)Yellow coded bin	47	21.10%
	d) common bin	124	78.21%

Fig. 1: Frequency and percentage distribution of responses given by private dental practitioners to various questions on infection control and waste management.
values are present as- N: Number of participants; %: Percentage of participants

The majority of private dental practitioners did not store waste beyond 24 hours. Human anatomical waste was commonly 48.0% disposed of in red coded bins. 43.9% of dentists correctly disposed of human anatomical waste in a yellow color container. The majority of practitioners stored lead foil in separate containers. [Fig.1]
Statistically significant differences [Fig. 2] were found regarding the type of gloves used more commonly during a dental procedure. Postgraduate private dental practitioners preferred to use nitrile gloves over

latex examination gloves. 56.1% of undergraduate practitioners used latex examination gloves for a routine dental examination.

Postgraduate private dental practitioners preferred to sterilize instruments in between patients 27.4% while 21.45% of graduate private dental practitioners preferred sterilization of instruments once daily. Graduate private practitioners washed impressions under running water 59%, while only 11.5 % of graduate practitioners followed the immersion technique for alginate impression sterilization. Statistically, a significant difference was found considering the type of disinfection method for alginate impression among graduate and post-graduate practitioners.

Regarding waste disposal, post-graduate practitioners were more aware of correct color coding for disposal of ampules, needles 47.6%, disposal of plastic items 33.3%, disposal of extracted teeth and 60.7%, disposal of x-ray lead foil 71.4%.

In our study, the disposal of biomedical waste in the correct color-coded bin was found to be directly proportional to the duration of practice. Statistically, significant differences were found among private dental practitioners of the highest and lowest duration of practice regarding disposal of needles, blades, and ampoules 71.04%, extracted human teeth, and excised soft tissue 53.60%. Less experienced practitioners were significantly more aware of the immunization status of assisting staff members.

DISCUSSION

The cross-sectional study design was preferred in this study as it allows the investigator to measure the outcome and the exposures in the study of practitioners at the same time. We can estimate the prevalence of disease in cross-sectional studies. Furthermore, we will also be able to estimate the odds ratios to study the association between exposure and the outcomes in this design. [10]

The advantage of using an online questionnaire as a data collecting method is the ability to collect a lot of data from a large number of respondents relatively quickly and inexpensively. It is very easy and convenient for respondents to complete surveys online. [11] Practitioners can fill out questionnaires when they choose to and start and stop a survey at their leisure. This gives control over completing the survey to the individual, which can increase engagement and response rates. [12]

Private dental practitioners were chosen as they are aware and responsible for infection control and waste management practices. Consultants and assistant dentists were excluded as they work under the guidance of the head practitioner and are not directly related to infection control measures and waste management practices at dental clinics. [13]

Privatedental practitioners were aware that sharps are hazardous and should be disposed of in puncture-resistant containers but reported using dustbins to dispose of sharps such as needles, knives, and ampoules. Another study done by Suresh et al. at Bangalore in India showed that 47.6% of dentists hand health care waste to street garbage collectors. [14]This showed that the lack ofknowledge regarding proper disposal of sharps and more awareness creation is required.

In the present study, most respondents did not segregate waste at the point of generation in the clinic. Possible reasons for this include: that surveyed dentists consider recommendations should be followed but are tedious; those practitioners consider it the responsibility of government to impose regulations, and that the imposition of regulations increases the financial and labor-associated burden on the dental practice. [15]

In the present study, Steam sterilization of the instruments was the method of choice for about 96.9% of the respondents. Suresh et al. 2012 reported that 78.4% of respondents were using an autoclave for sterilization. [16] In contrast in another study done by Bommireddy VS et al. 2016, only 53.8% prefer autoclave as a sterilization method. [17] Hands are considered a major infection source in dentistry, and wearing gloves by dental personnel is an essential element of cross-infection control. [18]In the present study, 49.2% of postgraduate degree practitioners use latex examination gloves in daily practice. Latex surgical gloves and nitrile gloves were used by graduate degree practitioners 25.6%. This can be attributed to the easy availability and low cost of latex surgical gloves and nitrile gloves. [19] Postgraduate practitioners more frequently sterilize instruments in between patients and dispose of waste 12 hourly while the majority of graduate practitioners dispose of waste 24 hours or more. This can be attributed to adequate basic infection control programs in dental schools but subsequent lack of constant reinforcement through continuing education courses and regularly updated recommendations circulated through dental schools, dental associations, and governmental agencies. [20]

A study has shown that various microorganisms infect 67% of materials sent to dental laboratories. Dental impressions are inevitably in contact with saliva, plaque, and blood, all of which contain potential pathogenic microorganisms. Impression materials exposed to infected saliva and blood provide a significant source of such infectious agents. [21] In our study, 48.4% percent of graduate practitioners use running water to disinfect an alginate impression. Dentists and clinical dental staff being at high risk for

hepatitis B infection must be vaccinated. [22] In the present study, about 53% of the respondents said their staff was not vaccinated or were not sure of the vaccination status. Moreover, the assistants keep varying from time to time in most of the clinics.

Practitioners with fewer years of clinical experience showed a significantly better level of infection control compared to other groups [Fig. 2].

		BDS	MDS	P value	<1 year	1 – 5 years	6-10 years	≥10 years	P value
1	A	56.1	36.9	**0.01**	47.5	51.8	20.8	64.3	0.124
	B	18.7	36.9		28.8	20.5	45.8	21.4	
	C	24.5	26.2		23.7	26.8	33.3	14.3	
	D	0.7	0		0	0.9	0	0	
2	A	63.3	51.2	**0.005**	100.00%	96.40%	87.50%	100.00%	0.323
	B	22.3	15.5		0.00%	0.90%	4.20%	0.00%	
	C	13.7	33.3		0.00%	1.80%	4.20%	0.00%	
3	A	97.1	96.4	0.963	0.00%	0.90%	4.20%	0.00%	
	B	0.7	1.2		33.90%	19.60%	29.20%	7.10%	0.088
	C	1.4	1.2		35.60%	37.50%	29.20%	53.60%	
	D	0.7	1.2		30.50%	42.90%	41.70%	39.30%	
4	A	20.1	27.4	0.443	44.10%	49.10%	75.00%	35.70%	0.202
	B	38.8	36.9		8.50%	8.00%	0.00%	7.10%	
	C	41	35.7		40.70%	33.90%	20.80%	53.60%	
5	A	14.4	8.3	**0.001**	6.80%	8.90%	4.20%	3.60%	
	B	17.3	7 8.3		25.40%	34.80%	25.00%	25.00%	0.501
	C	23	47.6		3.40%	0.90%	0.00%	0.00%	
	D	32.4	32.1		0.00%	0.90%	4.20%	3.60%	
	E	12.9	3 3.6		71.20%	63.40%	70.80%	71.40%	
6	A	43.9	57.1	**0.007**	57.60%	58.00%	45.80%	32.10%	0.177
	B	4.3	11.9		39.00%	33.90%	41.70%	57.10%	
	C	44.6	23.8		3.40%	8.00%	12.50%	10.70%	
	D	7.2	6 7.1		5.10%	8.90%	20.80%	7.10%	0.111
7	A	23	41.7	**0.019**	23.70%	31.20%	41.70%	28.60%	
	B	2.2	0		0.00%	0.90%	4.20%	3.60%	
	C	1.4	1.2		71.20%	58.90%	33.30%	60.70%	
8	A	53.2	53.6	0.978	32.20%	37.50%	29.20%	42.90%	
	B	38.8	39.3		55.90%	45.50%	41.70%	50.00%	
	C	7.9	6 7.1		78.00%	76.80%	75.00%	78.60%	0.526
9	A	9.4	8.3	0.333	11.90%	17.00%	25.00%	17.90%	
	B	26.6	35.7		10.20%	6.20%	0.00%	3.60%	
	C	0.7	2.4		27.10%	25.90%	16.70%	17.90%	0.676
	D	63.3	53.6		5.10%	6.20%	8.30%	10.70%	
10	A	11.5	22.6	**<0.001**	44.10%	33.90%	45.80%	50.00%	
	B	29.5	46.4		23.70%	33.90%	29.20%	21.40%	
	C	59	31		13.60%	17.90%	8.30%	7.10%	0.365
11	A	80.6	71.4	0.071	47.50%	51.80%	20.80%	64.30%	0.124
	B	12.2	23.8		28.80%	20.50%	45.80%	21.40%	
	C	7.2	4.8		23.70%	26.80%	33.30%	14.30%	
12	A	7.9	8.3	**<0.001**	0.00%	0.90%	0.00%	0.00%	
	B	58.3	31		100.00%	96.40%	87.50%	100.00%	0.323
	C	33.8	60.7		0.00%	0.90%	4.20%	0.00%	
13	A	29.5	15.5	**0.029**	0.00%	1.80%	4.20%	0.00%	
	B	6.5	6 7.1		0.00%	0.90%	4.20%	0.00%	
	C	33.1	51.2		33.90%	19.60%	29.20%	7.10%	0.088
	D	30.9	26.2		35.60%	37.50%	29.20%	53.60%	
14	A	15.8	11.9	**0.03**	30.50%	42.90%	41.70%	39.30%	
	B	754	71.4		44.10%	49.10%	75.00%	35.70%	0.202
	C	30.2	16.7		8.50%	8.00%	0.00%	7.10%	
15	A	20.1	27.4	0.294	40.70%	33.90%	20.80%	53.60%	
	B	10.8	7 8.3		6.80%	8.90%	4.20%	3.60%	
	C	23	14.3		25.40%	34.80%	25.00%	25.00%	0.501

Fig. 2: Percentage distribution of responses given by private Dental practitioners of different socio-demographic variables To various questions on infection control and waste management
N: Number of participants; %: Percentage of participants

Practitioners below 10 years of experience prefer to use latex examination gloves 60.89% compared to more clinically experienced practitioners. Less experienced practitioners are significantly more aware of the correct color coding of biomedical waste management compared to practitioners with 10 years or more of clinical experience. This result is in contrast to another study done by Kishor J. in Delhi in which more experienced practitioners reported better level of infection control practices. [23] Only 17.90 % of more experienced practitioners are not aware of the immunization status of staff, while 75% of below less experienced practitioners are aware of the immunization status of dental staff.

The qualification has a considerable impact on the ideal infection control and biomedical waste management practices. [24].The level of Infection control and biomedical waste management practices among Ahmedabad dental practitioners were more closely related to factors such as years of experience of dental practices and dental practitioners' education level. Similar studies at a large level with larger sample sizes and newer regions would help us to better understand the recent trends in infection control and biomedical waste management and hence ways to improve the current standards of practice.

CONCLUSION

Based on analysis of results and review of literature, it could be concluded that postgraduate practitioners and less experienced practitioners showed a more positive attitude and behaviors towards infection control measures and waste management practices as there was a statistically significant difference in values obtained.

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