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Original Article

Dentistry Section

Knowledge, Attitude and Practice of Green Dentistry among Dental Professionals of Bhopal City: A Cross-sectional Survey

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ABSTRACT

Introduction: Eco-friendly dentistry is an environment friendly way of practicing dentistry. It reduces wastage, conserves energy and decreases pollution.

Aim: The aim of this study is to assess the awareness and practices regarding eco-friendly dentistry among dental professionals of Bhopal city.

Materials and Methods: A cross-sectional survey was conducted among 200 dental professionals of Bhopal city to assess their knowledge and practice regarding eco-friendly dentistry. A modified predesigned questionnaire was used to collect the information of eco-friendly dentistry which consisted of 20 questions. Data was analysed with Statistical Package for Social Sciences (SPSS) version 21, IBM Inc by using chi-square test and $p<0.05$ was fixed as the level of significance.

Results: The study included 200 participants of which 65 were pursuing post graduation (PG Students), 40 were practicing Postgraduates (MDS) and 95 were practicing Graduates (BDS). The term green dentistry was heard before by 21 (52.5%) Postgraduates, 46 (48.4%) Graduates and 53 (81.5%) PG Students. Lack of enough knowledge regarding green dentistry was the prime factor that influenced the adoption of green dentistry between study subjects.

Conclusion: The current study revealed that knowledge, awareness and practice regarding green dentistry were not up to the mark. As dentistry is a profession that consumes a lot of resources and in a country like India where water and electricity are deficient in many parts thus conservation of resources is paramount. This goal can only be achieved when all dentists have adequate knowledge regarding eco-friendly dentistry.

Keywords: Composite, Conserve, Digital system, Global hazards, Reusable

INTRODUCTION

In today's scenario where a colossal number of dentists are practicing, this profession contributes a very heavy metallic load which exploits the environment. This extremely emphasises the need for "Eco-friendly" dentistry [1]. Dr. Malden Kralj the initiator of America's first green dental group, coined the term "Eco-friendly dentistry" [2]. Eco-friendly dentistry a way of practicing that implicates various method and machinery which can reduce waste, decrease pollution, conserve energy and save money [3]. According to Popa D et al., overall dental practice generates approximately 4.8 million lead sheets along with the generation of radiographic toxic substances, mercury waste and chair covers, that account to almost 28 million litres, 3.7 tons and 680 million, respectively [4]. Healthcare waste is classified as general waste and hazardous waste. General waste refers to a waste where a large portion originates from food preparation, housekeeping activities and administrative sector. Hazardous waste originates out of healthcare delivery process-comprises laboratory wastes, body fluids and sharp wastes. Both type of waste should be properly segregated at their source of generation. According to the WHO estimation, 10-25% of the Health Care Waste is considered to be hazardous. About 30 dangerous blood borne pathogens can be transmitted from the Health Care Waste [5].

As dentistry is one of the important healthcare sector and equivalently responsible for global hazards, therefore knowledge regarding eco-friendly dental practice is essential among dental professionals. There are studies from different parts of India but not from Bhopal city hence this pioneer study was conducted to assess the knowledge and practices towards eco-friendly dentistry among dental practitioners in Bhopal City because a healthy comprehensive environment is an imperative need for survival of the human race and living species. This study also fills the gap with the existing literature as the study includes ongoing Post Graduates students who have been practicing since graduation and would soon be practicing in their own dental set-up in future.

MATERIALS AND METHODS

A cross-sectional survey was conducted during 15 July 2019 to 30 July 2019 among dental practitioners of Peoples Dental Academy in Bhopal city to assess their knowledge and practice regarding eco-friendly dentistry. All study protocol were reviewed and approved by the Institutional Ethical Committee-(2019/700/misc./01) and participants were informed and written consent was obtained. There were total 200 dentists (practitioners & PG Students) who were randomly chosen and a modified predesigned questionnaire [6-8] was used to collect the information regarding eco-friendly dentistry. Intra examiner reliability score was -0.81-1.00. Data was collected with the help of questionnaires filled by participants.

Inclusion Criteria: Only dentists from Peoples dental academy, Bhopal were included in the study.

Exclusion Criteria: Non-practitioners were not included in the study. Individuals who were not interested were excluded from the study.

There were total 20 questions out of which 10 questions were related to knowledge about green dentistry whereas other 10 questions were about practice of green dentistry.

Questionnaires were distributed by the investigator among all study participants in Peoples Dental Academy. The Questionnaire were filled in front of distributor and personally collected on the same day by the distributor and it was completely filled by the participants. Individual's information was kept confidential.

STATISTICAL ANALYSIS

Data was entered in excel sheet and analysed with SPSS version 21, IBM Inc by using chi-square test and $p<0.05$ was fixed as the level of significance.

RESULTS

The total participants were 200 out of which 40 were Postgraduates, 65 were PG students and 95 were Graduates from 25 to 50 years [Table/Fig-1]. Out of total participants 60% (120) were female and 40% (80) were male. Postgraduates had 8 to 10 years of practice, PG students had 1-3 years of practice and Graduates had about 2-5 years of experience.

Total participants	N	Minimum (years)	Maximum (years)	Mean (years)	Standard deviation
Graduates	95	20.00	24.00	23.42	0.82
Post Graduates students	65	25.00	29.00	27.13	0.89
Post Graduates	40	30.00	50.00	36.95	4.80

[Table/Fig-1]: Depicting the mean age of the participants.

[Table/Fig-2] depicts the knowledge regarding eco-friendly dentistry among study participants. Results showed that 21 (52.5%) Postgraduates, 46 (48.4%) Graduates and 53 (81.5%) PG students heard the term green dentistry and the difference was statistically significant with the p-value 0.001. Lack of enough knowledge to proceed was the main factor that influences the adoption of green dentistry between study subjects and this difference was statistically considerable p-value (0.032). When knowledge was assessed based on the use of computer-based record system for paper waste management, majority said that they use computer-based record system and the distinction was significant.

[Table/Fig-3] depicts the practice regarding eco-friendly dentistry among study participants. It illustrates that 11 (27.5%) Post Graduates, 15 (23.1%) PG students and 37 (38.9%) Graduates recycled the fixer and developer solution timely/regularly with a statistically significant p-value of 0.002. In this study 30 (75.0%) Post Graduates, 50 (76.9%) PG students and 64 (67.4%) Graduates used reusable lab coats and patient drapes with statistically noteworthy value. Practicing eco-friendly dentistry proves that Glass ionomer cement and composite restoration was chosen as an alternative to amalgam filling by the majority of study subjects. Majority of participants in this study used sterilisation of instruments like trays, film holding devices over disposable products with significant p-value 0.02.

DISCUSSION

The present study was conducted to assess the knowledge and practice regarding eco- friendly dentistry among dental practitioners of Peoples Dental Academy in Bhopal city.

In the present study, majority of female participants 120 (60%) and less number of male dentists 80 (40%) participated whereas in a study by Al-Qarni MA et al., majority of male participants (78.5%) and less number of female dentists (21.25%) participated [9].

A study conducted in Udaipur by Sen N et al., included 300 dentists who were divided in 3 groups in which 60% of study participants were aware of the term green dentistry [7]. Another study conducted in Hyderabad by Prathima V et al., found that only 13.1% study population was aware of the term Eco-Friendly Dentistry (EFD) [10]. In the present study most of the PG students 53 (81.5%) heard the term green dentistry. This indicates that there is a need to evolve our current practice into eco-friendly practice. Majority of the postgraduates (75.0%) used LED Light bulbs/CFL as these utilises

Q1. Are you aware of the term green dentistry?			
	Heard before	Heard for First time	p-value
Post Graduates student	53 (81.5%)	12 (18.5%)	0.001*
Post Graduates	21 (52.5%)	19 (47.5%)	
Graduates	46 (48.4%)	49 (51.6%)	

Q2. What are the factors that are influencing the adoption of green dentistry?				
	Cost	Not enough knowledge to proceed	Not enough time	
Post Graduates student	23 (35.4%)	38 (58.5%)	4 (6.2%)	0.032*
Post Graduates	5 (12.5%)	31 (77.5%)	4 (10.0%)	
Graduates	33 (34.7%)	60 (63.2%)	2 (2.1%)	

Q3. Is there a need to promote reusable metal air/water syringes & suction devices, biodegradable cups?			
	Yes	No	
Post Graduates students	56 (86.2%)	9 (13.8%)	0.360
Post Graduates	37 (92.5%)	3 (7.5%)	
Graduates	79 (83.2%)	16 (16.8%)	

Q4. What should be the preferred type of flooring?					
	Vinyl	PVC (Polyvinyl chloride)	linoleum/cork	None	
Post Graduates students	12 (18.5%)	26 (40.0%)	5 (7.7%)	22 (33.8%)	0.449
Post Graduates	14 (35.0%)	13 (32.5%)	2 (5.0%)	11 (27.5%)	
Graduates	23 (24.2%)	42 (44.2%)	8 (8.4%)	22 (23.2%)	

Q5. Should we go digital to eliminate photochemical waste?				
	Yes	No	Maybe	
Post Graduates students	59 (90.8%)	5 (7.7%)	1 (1.5%)	0.376
Post Graduates	38 (95.0%)	2 (5.0%)	0 (0.0%)	
Graduates	86 (90.5%)	4 (4.2%)	5 (5.3%)	

Q6. Do you use computer-based record system for paper waste management?				
	Yes	No	Sometimes	
Post Graduates students	23 (35.4%)	36 (55.4%)	6 (9.2%)	0.007*
Post Graduates	17 (42.5%)	12 (30.0%)	11 (27.5%)	
Graduates	49 (51.6%)	30 (31.6%)	16 (16.8%)	

Q7. Do you use Tree oil/thyme/natural disinfecting agents as a surface disinfectant in the clinic?				
	Yes	No	Sometimes	
Post Graduates students	17 (26.2%)	38 (58.5%)	10 (15.4%)	0.128
Post Graduates	17 (42.5%)	13 (32.5%)	10 (25.0%)	
Graduates	30 (31.6%)	50 (52.6%)	15 (15.8%)	
Q8. Do you prefer cloth instruments wrap over paper & plastic autoclave bags for the steam sterilisation?				
	Yes	No		
Post Graduates students	49 (75.4%)	16 (24.6%)		0.649
Post Graduates	33 (82.5%)	7 (17.5%)		
Graduates	76 (80.0%)	19 (20.0%)		
Q9. Should Eco-friendly dentistry be universally recommended?				
	Yes	No	Maybe	
Post Graduates students	60 (92.3%)	2 (3.1%)	3 (4.6%)	0.323
Post Graduates	37 (92.5%)	2 (5.0%)	1 (2.5%)	
Graduates	79 (83.2%)	6 (6.3%)	10 (10.5%)	
Q10. Does Dental office infection control and sterilisation processes can be a major source of a waste generation & pollution?				
	Yes	No		
Post Graduates students	50 (76.9%)	15 (23.1%)		0.884
Post Graduates	31 (77.5%)	9 (22.5%)		
Graduates	76 (80.0%)	19 (20.0%)		

[Table/Fig-2]: Knowledge regarding eco-friendly dentistry among study participants.
*Denotes significant p-value <0.05, Chi-square test applied to compare frequency

Q1. Do you recycle the fixer and developer solution?				
	Yes	No	Sometimes	p-value
Post Graduates Student	38(58.5%)	23(35.4%)	4 (6.2%)	0.032*
Post Graduates	31 (77.5%)	5 (12.5%)	4 (10.0%)	
Graduates	60 (63.2%)	33 (34.7%)	2 (2.1%)	
Q2. Where do you dispose of mercury?				
	In Liquid	In Garbage		
Post Graduates student	32 (49.2%)	33 (50.8%)		0.177
Post Graduates	27 (67.5%)	13 (32.5%)		
Graduates	51 (53.7%)	44 (46.3%)		
Q3. What type of Lab coats and patient drapes is being used in your practice?				
	Reusable	Non-reusable	Both	
Post Graduates student	50 (76.9%)	12 (18.5%)	3 (4.6%)	0.05*
Post Graduates	30 (75.0%)	3 (7.5%)	7 (17.5%)	
Graduates	64 (67.4%)	12 (12.6%)	19 (20.0%)	
Q4. What do you use for energy management?				
	Normal lights/ bulbs	LED Light bulbs/CFL		
Post Graduates student	27 (41.5%)	38 (58.5%)		0.102
Post Graduates	10 (25.0%)	30 (75.0%)		
Graduates	26 (27.4%)	69 (72.6%)		
Q5. What type of dental vacuum pump do you use?				
	Dry dental vacuum pump	Wet dental vacuum		
Post Graduates student	43 (66.2%)	22 (33.8%)		0.984
Post Graduates	27 (67.5%)	13 (32.5%)		
Graduates	64 (67.4%)	31 (32.6%)		
Q6. What do you use as an alternative to amalgam filling?				
	Composite	Glass ionomer cement		
Post Graduates student	40 (61.5%)	25 (38.5%)		0.001*
Post Graduates	12 (30.0%)	28 (70.0%)		
Graduates	31 (32.6%)	64 (67.4%)		
Q7. Do you use sterilisation instruments like trays, film holding devices rather than disposable products?				
	Yes	No	Sometimes	
Post Graduates student	50 (76.9%)	14 (21.5%)	1 (1.5%)	0.02*
Post Graduates	27 (67.5%)	5 (12.5%)	8 (20.0%)	
Graduates	73 (76.8%)	13 (13.7%)	9 (9.5%)	

Q8. Do you reduce water wastage during hand washing?				
	Yes	No	Sometimes	
Post Graduates student	41 (63.1%)	10 (15.4%)	14 (21.5%)	0.358
Post Graduates	31 (77.5%)	3 (7.5%)	6 (15.0%)	
Graduates	63 (66.3%)	8 (8.4%)	24 (25.3%)	
Q9. Do you unplug all electric appliances after use?				
	Yes	No	Sometimes	
Post Graduates student	45 (69.2%)	10 (15.4%)	10 (15.4%)	0.272
Post Graduates	31 (77.5%)	5 (12.5%)	4 (10.0%)	
Graduates	80 (84.2%)	8 (8.4%)	7 (7.4%)	
Q10. Which type of green design of dental unit you are practicing?				
	Use of paints on internal walls free of VOC (volatile organic compound)	Indoor greenery	None	
PG student	8 (12.3%)	22 (33.8%)	35 (53.8%)	0.085
Post graduates	13 (32.5%)	13 (32.5%)	14 (35.0%)	
Graduates	27 (28.4%)	29 (30.5%)	39 (41.1%)	

[Table/Fig-3]: Practice regarding eco-friendly dentistry among study participants.
*Denotes significant p-value <0.05, Chi-square test applied to compare frequency

low voltage and found to be durable whereas in a study conducted by Kallakuri P et al., it was seen that only 45% practitioners were in favour of using the LED lights bulbs [11]. Majority of the Post Graduates (67.5%) disposed mercury in liquid whereas 50.8% of PG Students, followed by 46.3% of Graduates disposed mercury in garbage this is because there is unawareness amongst the participants regarding the harmful effects of mercury exposure.

Chopra A et al., found that most of the dentists (98%) followed eco-friendly dental practices including the alternatives to amalgam filling [12]. Similarly in the present study 67.4% participants used Glass Ionomer Cement and composite was used as a filling material by 61.5% participants as an alternative to amalgam for restoration. This is not in congruent with the study conducted by Sawair FA et al., who stated that amalgam was used by 76% of Jordanian dental practitioners [13]. Al Shatrat SM et al., did a study on eco-friendly dentistry and found that presently such subject has not been inculcated in the dental curriculum so this concept should be made accessible to all dental health care professionals and students at a primary level [6].

Bhargava A and Anand B, found that 64.5% of participants said that lack of enough knowledge was the main factor that influences the adoption of green dentistry whereas 30.5% said that the cost of green dentistry hinders its adoption [14]. The study mentioned 45.6% of practitioners thought that the practice of eco-friendly dentistry would increase financial burden and ultimately they have to cover their expenses through patients.

In a review article by Farahani D et al., digital system was used and 12,600 papers were saved annually which also eliminated the need for X-ray films, fixing and developer solutions for taking radiographs [15]. Similarly, in the present study paper waste management was carried out by 44.5% participants with computer- based record system. Another study done in Lucknow by Rahman H et al., stated in this regard that we must reduce the consumption of paper and initiate the use of electronic and digital methods which will also reduce deforestation and will retard global warming [16]. As per the present study, 91.5% of subjects used a digital system to eliminate photochemical waste because they found digital radiography is more convenient and decreases operating time and it also provides better efficiency in image diagnosis.

According to Popa D et al., recycling, in the long run, would be more cost-effective and can help by saving money energy and natural resource [4]. In the present study majority of the participants -Graduates 60 (63.2%), PG students 38 (58.5%) and Post Graduates 31 (77.5%) said that they recycle developer and fixer solution timely and only few do not recycle it on the regular basis. In a study conducted by Ramesh KK et al., it was observed that amalgam remnants were disposed along with other routine wastes by 19.33% practitioners, tight containers for amalgam disposal were used by 22% participants and only 16% of practitioners disposed amalgam waste separately [17]. The present study found that 55% participants disposed off mercury in liquid. International Academy of Oral Medicine and Toxicology recommended SMART i.e., Safe Mercury Amalgam Removal Technique for the routine practice of safe mercury disposable that helps in reducing the risk of mercury exposure faced by the patient and practitioner [18]. In a study done in 2016 by AL-Qarni MA et al., remarkable difference in the knowledge was obtained after power point presentation of the subject in the population [9].

Chin G et al., found that due to the poor waste management of dental amalgam there is harmful impact on environment [19]. In order to reduce the amalgam contaminated water from dental clinics amalgam separators can be used. A study in Thailand reported that dentists of Thai showed a high level of implementation of proper waste management strategies and had positive attitudes regarding radiographic management [8]. This could be because some topics in green dentistry have been promoted in Thailand for several years, whereas in the present study the knowledge was not up to the mark because the subject of green dentistry has not been promoted. In the present study, it was analysed that Postgraduates had more knowledge compared to PG students and Graduates since they had more years of practice in their specific field. Majority of the Postgraduates (75%) used more LED light bulbs in dental set up compared to PG students and Graduates. Also, Postgraduates (67.5%) had properly disposed mercury in the liquid whereas PG students and Graduates disposed mercury in garbage bin. Postgraduates adequately used reusable air/water syringes, suction devices, biodegradable cups. It was found that majority of the Post Graduates students (38.5%) used Glass Ionomer Cement for restoration of teeth as an alternative to amalgam fillings preventing mercury toxicity. Postgraduates (32.5%) used paints free of volatile organic compounds compared to PG students and Graduates.

Thus awareness plays a key in the practice of green dentistry and initiation of inculcating such subject is very essential. The government has also taken initiative in reducing waste by inculcating the waste disposal in specific colour dustbins i.e., -Blue colour dustbin for wet wastage and green colour for dry waste stuff. The use of plastic has been banned by the government and replaced with the paper bags and paper disposal glasses. Recently government has introduced vehicles to collect the wastage from door to door. Therefore, we as

dental professionals should also participate actively and support the government to make our country healthy and green.

Limitation(s)

The present study was carried out at Institutional level among the practitioners coming from different parts of Bhopal and did not include individual practitioners or dentists belonging to various institutions of Bhopal city. As opinions are subject to personal likes and dislikes, further study can be conducted involving mass population of dentists in and around the city.

CONCLUSION(S)

Dentistry also contributes in health care waste that ultimately promotes the global hazards and harm to the human health. In the present study, it was found that participants knowledge and practice regarding green dentistry is not up to the mark so in order to accomplish the goal of making green dentistry a global phenomena and contribute in reducing global hazards, all dentists must contribute at their level by updating their knowledge regarding the subject so as to bring it out in practice.

In the coming future a new subject should be incorporated in dental curriculum. The knowledge about green dentistry can be spread amongst the population of dentists in Bhopal city by campaigning in regards to the subject and by conducting CDE programmes.

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