



**ASSESSMENT OF ATTITUDE AND IMPLEMENTATION OF ECO-FRIENDLY
DENTAL OFFICE STRATEGIES AMONG DENTAL PRACTITIONERS IN A CITY
PRACTICE AREA OF SOUTH INDIAN STATE**

Dental Science

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ABSTRACT

Aim: To assess the attitude and implementation of eco-friendly dental office strategies among dental practitioners in Rajahmundry city.

Methodology: A cross-sectional study was conducted over a period of 2 months from September to November 2017 among registered dental practitioners of Rajahmundry city. A pre tested, pre designed questionnaire was used and collected after one day so that sufficient time will be provided for practitioners to answer it.

Results: 90% of practitioners agreed that green practices can play a role in environment and 80% practitioners agreed that green practices has many long term benefits of which both were found to be statistically significant. 63.3% of practitioners found that green dentistry can be compatible with previous standard and new features to be influential.

Conclusion: Current study suggests that implementation strategies of eco-friendly dental practices among the dental practitioners of Rajahmundry is not adequate.

KEYWORDS

green dentistry, eco-friendly practices, dental practitioners

INTRODUCTION:

The modern global issue is the preservation of the environment¹. Global warming owing to environmental pollution is disturbing the balance of nature and inflicting chaos everywhere around the globe. Human health is extremely affected by the significant adverse effects of climate change². As stated by World Health Organization a total of about 35,000 tons of healthcare waste annually and about 1000 tons daily is produced by SEARO, the 11 South Asian countries³. The dentist uses a wide range of materials and instruments to enhance dental health and overall wellbeing. Dental health care is devoted to endorse and enhance oral health and well-being and to achieve such goals, dentists use a diversity of materials and instruments. Unfortunately, particular materials that are currently in use include heavy metals as well as biomedical waste, offer impending challenges to the ecological stability⁴. It is the duty of the dental professionals to safeguard the natural resources and to decrease the influence of lethal waste generated from the practices of nature¹. "Eco-Dentistry or Green Dentistry" has been recognized which has taken dentistry beyond the point of preventing pollution to a place of promoting sustainability¹. The eco-dentistry association (EDA), and educational and membership association had developed a model for green dental professionals.

Green Dentistry is defined as a high-tech approach that reduces the environmental impact of dental practices and encompasses a service model for dentistry that supports and maintains wellness by the Eco-Dentistry Association (EDA)⁵. The key concepts of eco dentistry include the strategic ideas of eco-dentistry include water and energy, reduction of waste, practice of non-toxic products, reducing waste and eliminating lethal toxins⁶. To determine the financial advantages of eco-friendly dentistry an extended investigation has to be done⁷. It is the time for the dentist's to become environmentally conscious and to create their dental practices eco-friendly and there is scarcity in the literature the present study was conducted with the aim to assess the attitude and implementation of eco-friendly dental office strategies among dental practitioners in Rajahmundry city.

MATERIALS AND METHODS:

A cross-sectional study was conducted over a period of 2 months from September to November 2017 among registered dental practitioners of Rajahmundry city. Prior ethical clearance was obtained from the Institutional Ethical Committee (IEC) in full accordance with the World Medical Association Declaration of Helsinki. Only private practitioners were considered for this study as public sector dentists does not have the choice for eco-friendly policies and procedures. List of private dental practitioners was obtained from the District Medical and Health Office (DMHO), East Godavari district and before starting the study, informed written consent was obtained from the participants. A pre tested, pre designed questionnaire was used. It consists of two sessions: Demographic data and questions regarding attitude, and implementation. The questionnaire was distributed and collected after one day so that sufficient time will be provided for practitioners to answer it. A pilot study was done to determine the feasibility of the survey. From the lists obtained, a total of 150 private dental practitioners were approached to participate in the survey. Participants who were not willing to participate in the study or who were absent during three consecutive visits were excluded from the study. The final sample consisted of 120 dentists.

Statistical Analysis:

Data was entered into the Microsoft Word Excel Sheet 2010 version and was analyzed using the Statistical Package for the Social Sciences version 23.0 software (SPSS Inc., Chicago, IL, USA). Descriptive analysis for demographic variables, knowledge, attitude and implementation of eco-friendly dental office strategies were computed. Further, chi-square test was applied. $P \leq 0.05$ was considered statistically significant.

RESULTS:

Table 1 shows the distribution of study participants according to qualification and gender:

It was observed that maximum of the study participants were males [n=102 (85%)]. Majority of the study subjects were Master of Dental Surgery qualified (MDS) [n=64 (91.4%)].

Table 1: Distribution of study participants according to qualification

	GENDER			TOTAL
		MALE	FEMALE	
Qualification	BDS	38(76.0%)	12(24.0%)	50(41.6%)
	MDS	64(91.4%)	06(8.6%)	70(58.3%)
Total		102(85.0%)	18(15.0%)	120

Table 2 represents the attitude regarding green dentistry among study subjects:

90% of practitioners agreed that green practices can play a role in environment and 80% practitioners agreed that green practices has many long term benefits of which both were found to be statistically significant ($P=0.001$).38.3% of practitioners disagreed that there is

difficulty on changing from current practice to green practice.63.3% of practitioners are not sure whether green practice will increase financial burden which was found to be statistically significant ($P=0.052$).41.7% are not sure whether there is any difficulty in finding products compatible with green dentistry.58.3% of practitioners thought that there is influence of eco-friendly practices on increasing patient satisfaction which was found to be statistically significant.51.7% of practitioners believed that there is influence of eco-friendly practices on providing lower operating and maintenance costs which was also found to be statistically significant ($P=0.012$).63.3% of practitioners found that green dentistry can be compatible with previous standard and new features to be influential.

Table 2: Represents the attitude regarding green dentistry among study subjects

		BDS	MDS	TOTAL	STATISTICAL INFERENCE
Green practices can play a role in environment	Agree	40(80%)	68(97%)	108(90.0%)	Chi Square Test:16.381 P==0.001
	Not sure	8(16%)	0(0%)	8(6.7%)	
	Disagree	2(4%)	2(2.9%)	4(3.3%)	
Green practices has many long term benefits	Agree	32(64%)	64(91.4%)	96(80.0%)	Chi Square Test:14.275 P==0.001
	Not sure	16(32%)	6(8.6%)	22(18.3%)	
	Disagree	2(4%)	0(0%)	2(1.7%)	
Difficulty on changing from current practice to green practice:	Agree	18(36.0%)	26(37.1%)	44 (36.7%)	Chi Square Test:2.587 P=0.274
	Not sure	16(32.0%)	14(20.0%)	30(25.0%)	
	Disagree	16(32.0%)	30(42.9%)	46(38.3%)	
Green practice will increase financial burden:	Agree	06(12.0%)	16(22.9%)	22(18.3%)	Chi Square Test:5.922 P*==0.052
	Not sure	38(76.0%)	38(54.3%)	76(63.3%)	
	Disagree	6(12.0%)	16(22.9%)	22(18.3%)	
Difficulty in finding products compatible with green dentistry:	Agree	14(28.0%)	30(42.9%)	44(36.7%)	Chi Square Test:7.252 P=0.27
	Not sure	28(56.0%)	22(31.4%)	50(41.7%)	
	Disagree	08(16.0%)	18(25.7%)	26(21.7%)	
Influence of eco-friendly practices on increasing patient satisfaction:	Influential	26(52.0%)	44(62.9%)	70(58.3%)	Chi Square Test:1.744 P=0.418
	Slightly Influential	20(40.0%)	20(28.6%)	40(33.3%)	
	Not Influential	04(08%)	06(8.6%)	10(8.3%)	
Influence of eco-friendly practices on providing lower operating and maintenance costs	Influential	18(36.0%)	44(62.9%)	62(51.7%)	Chi Square Test:8.788 P==0.012
	Slightly Influential	28(56.0%)	24(34.3%)	52(43.3%)	
	Not Influential	04(08%)	02(2.9%)	6(5.0%)	
Green dentistry can be compatible with previous standard and new features	Influential	28(56.0%)	48(68.6%)	76(63.3%)	Chi Square Test:1.985 P=0.371
	Slightly Influential	20(40.0%)	20(28.6%)	40(33.3%)	
	Not Influential	02(4.0%)	02(2.9%)	4(3.3%)	

Table 3 illustrates the implementation of green dentistry among study subjects.

Majority of dental practitioners followed eco-friendly dental practices including alternate to amalgam fillings [n=98(81.7%)],use of digital radiography [n=110(91.7%)],using educational videos to explain the recommendations of different dental procedures[n=32(26.75)],using

sterilizable instruments, trays and film holding devices rather than disposable products [n=58(48.3%)],using cloth lab coats that can be laundered rather than disposable ones[n=98(81.7%)],using LED light bulbs [n=54(45%)],using hand sanitizer [n=80(66.7%)].Majority of the practitioners[n=62(51.7%)] chosen that they are aware of the strategy but not implementing the eco-friendly practices.

Table 3: Illustrates the implementation of green dentistry among study subjects

		BDS	MDS	TOTAL	STATISTICAL INFERENCE
AMALGAM MANAGEMENT	Pre capsulated alloys in different size	0(0%)	2(2.9%)	2(1.7%)	Chi Square test:2.970 P=0.027
	Dispose amalgam in means other than regular trash	0(0%)	0(0%)	0(0%)	
	Keep unused amalgam particles in well-sealed containers	6(12.0%)	14(20%)	20(16.7%)	
	Use amalgam separators	0(0%)	0(0%)	0(0%)	
	Use alternatives to amalgam fillings	44(88%)	54(77.1%)	98(81.7%)	
RADIOGRAPHIC MANAGEMENT	Mix and store chemicals(manufacturer's recommendations) to avoid waste	0(0%)	0(0%)	0(0%)	Chi Square test: 9.887 P==0.042
	Purchase developer, fixer in concentrated form	2(4.0%)	0(0%)	2(1.7%)	
	Use waste management program to dispose lead foils	0(0%)	0(0%)	0(0%)	
	Use waste management program to dispose fixer	0(0%)	2(2.9%)	2(1.7%)	
	Use digital radiography	46(92%)	64(91.4%)	110(91.7%)	
	Reuse x-ray mounts for new patients when purging old files	2(4.0%)	0(0%)	2(1.7%)	
PAPER WASTE MANAGEMENT	Purchase developer, fixer in concentrated form and Use digital radiography	0(0%)	4(5.7%)	4(3.3%)	Chi Square test: 32.206 P==0.002
	Recycle dental office paper waste	0(0%)	2(2.9%)	2(1.7%)	
	Print on both sides of paper when possible	06(12.0%)	06(8.6%)	12(10.0%)	
	Use computer based record systems	02(4.0%)	10(14.3%)	12(10.0%)	
	Use practice management software	02(4.0%)	10(14.3%)	12(10.0%)	
	Implement patient electronic messaging services	06(12.0%)	10(14.3%)	16(13.3%)	
	Use educational videos to explain the recommendations of different dental procedures	24(48.0%)	08(11.4%)	32(26.7%)	

	Use recycled paper products	0(0%)	04(5.7%)	4(3.3%)	
	Use scrap office/computer paper for scratch pads and internal notes	0(0%)	04(5.7%)	4(3.3%)	
	Donate old magazines to community centers	0(0.0%)	0(0.0%)	0(0.0%)	
	Donate old dental books to libraries, schools	0(0%)	0(0%)	0(0%)	
	Recycle dental office paper waste and Use computer based record systems	2(4.0%)	2(2.9%)	4(3.3%)	
	Use computer based record systems and Use educational videos to explain the recommendations of different dental procedures	2(4.0%)	07(8.6%)	9(7.5%)	
	Use computer based record systems,Use educational videos to explain the recommendations of different dental procedures and Use scrap office/computer paper for scratch pads and internal notes	2(4.0%)	2(2.9%)	4(3.3%)	
	Recycle dental office paper waste, Use computer based record systems and Use educational videos to explain the recommendations of different dental procedures	0(0%)	0(0%)	0(0%)	
	Use computer based record systems and Use scrap office/computer paper for scratch pads and internal notes	0(0%)	0(0%)	0(0%)	
	Print on both sides of paper when possible and Use educational videos to explain the recommendations of different dental procedures	3(6.0%)	2(2.9%)	5(4.2%)	
	Use computer based record systems and .Use scrap office/computer paper for scratch pads and internal notes.	0(0%)	2(2.9%)	2(1.7%)	
	All options	01(2.0%)	01(1.4%)	2(1.7%)	
INFECTION CONTROL MANAGEMENT	Purchase supplies in bulk packaging	0(0.0%)	2(2.9%)	2(1.7%)	Chi Square Test:31.553 P*=0.001
	Use steam sterilization with cloth instrument wraps versus paper and plastic autoclave bags	10(20%)	18(25.7%)	28(23.3%)	
	Use enzyme based cleaners that are biodegradable	02(4.0%)	02(2.9%)	4(3.3%)	
	Use nontoxic, non corrosive disinfectant wipes instead of pump spray bottles	0(0.0%)	0(0.0%)	0(0.0%)	
	Use sterilizable instruments ,trays and film holding devices, rather than disposable products	34(68.0%)	24(34.3%)	58(48.3%)	
	Use nontoxic, non corrosive disinfectant wipes instead of pump spray bottles and Use sterilizable instruments ,trays and film holding devices, rather than disposable products	0(0.0%)	22(31.4%)	22(18.3%)	
	Use enzyme based cleaners that are biodegradable and Use sterilizable instruments ,trays and film holding devices, rather than disposable products	4(8.0%)	0(0.0%)	4(3.3%)	
REUSABLE PRACTICES AMONG DENTIST	Use reusable glass/metal cups	02(4.0%)	12(17%)	14(11.7%)	Chi Square Test:13.197 P*=0.010
	Use reusable metal air/water syringes and suction devices	0(0.0%)	4(5.7%)	4(3.3%)	
	Use cloth lab coats that can be laundered rather than disposable ones	44(88%)	54(77%)	98(81.7%)	
	Use reusable glass/metal cups and Use cloth lab coats that can be laundered rather than disposable ones	2(4.0%)	0(0.0%)	2(1.7%)	
	Use reusable glass/metal cups, Use reusable metal air/water syringes and suction devices, Use cloth lab coats that can be laundered rather than disposable ones, Use reusable glass/metal cups and Use cloth lab coats that can be laundered rather than disposable ones	2(4.0%)	0(0.0%)	2(1.7%)	
WATER CONSERVATION	Use water faucet sensors	4(8.0%)	10(14.3%)	14(11.7%)	Chi Square test:7.331 P*=0.119
	Use hand dryers	2(4.0%)	0(0.0%)	2(1.7%)	
	Use hand sanitizer	30(60%)	50(71.4%)	80(66.7%)	
	Instruct the patients to turn off water faucet during tooth brushing at home	10(20%)	8(11.4%)	18(15.0%)	
	Use hand sanitizer, Instruct the patients to turn off water faucet during tooth brushing at home	4(8%)	2(2.9%)	6(5.0%)	
ENERGY MANAGEMENT	Use of LED light bulbs	14(28.0%)	40(57.1%)	54(45.0%)	Chi Square test:21.562 P*=0.001
	Dispose the burned bulbs into hazardous waste or recycle it	0(0%)	0(0%)	0(0%)	
	Use renewable energy such as wind or solar power	2(4.0%)	0(0%)	2(1.7%)	
	Use automated thermostats to control heating/cooling systems	(0%)	6(8.6%)	6(5.0%)	
	Turn off and unplug all electrical appliances after use	22(44.0%)	14(20.0%)	36(30.0%)	
	Use motion detectors for room lighting	0(0%)	0(0%)	0(0%)	
	Use of LED light bulbs and Turn off and unplug all electrical appliances after use	6(12.0%)	6(8.6%)	12(10.0%)	
	Use of LED light bulbs and Use motion detectors for room lighting	04(8.0%)	04(5.7%)	8(6.7%)	
IMPLEMENTATION OF GREEN DENTISTRY/ECO-FRIENDLY DENTISTRY	Fully in place	0(0%)	02(2.9%)	2(1.7%)	Chi Square test:2.174 P*=0.337
	In progress	26(52.0%)	30(42.9%)	56(46.7%)	
	Aware of strategy-but not implemented	24(48.0%)	38(54.3%)	62(51.7%)	

*P ≤ 0.05 is considered to be statistically significant

DISCUSSION:

In India green dentistry is still a progressing practice while in several countries it has been developed for several years². In the present study, 102(85%) males and 18(42.7%) female dentists had participated

which was similar to a study (Al-Qarni *et al*, 2016)⁴ where there is higher proportion of males (78.5%) and less number of female dentists (21.25%), contrary to this finding another study (Bhargava and Anand, 2017)³ had considered where 53% men and 47% women participants.

The present study findings depicted that 108(90%) agreed that green practices can play a role in environment conservation which is similar to the study conducted by Bhargava and Anand, 2017² which showed that 58.9 % of the practitioners agreed to the same. A possible reason for the dentists knowing more about the concept of green practices and their role in environment conservation might be because that they are in regular association with books, journals, research work and in union, implementing the facts which they obtain from recent literature and studies worldwide.

It was observed that 96(80%) of the practitioners agreed that green practice has many long term benefits which was similar to the study conducted by Bhargava and Anand, 2017² where 84.4% agreed to same. A study in Thailand⁸ reported that 91.1 % practitioners believed that green practice has many long term benefits which was slightly more than the present study, more awareness regarding benefits of green practice has to be created to overcome this gap.

76(63.3%) dental practitioners are uncertain about green practice will increase financial burden. Contrary findings were observed in study conducted by Bhargava and Anand, 2017² where 45.6% practitioners believed that green practice would increase financial burden on them. And another study (Chopra and Raju, 2017)⁹ also uplifted a different view that declared majority of respondents chose "the cost" as the most common barrier to the implementation of eco-friendly practices.

Eco-friendly practices on providing lower operating and maintenance costs is influential 62(51.7%) according to the results depicted by the present study which is similar to the study conducted by Bhargava and Anand, 2017² in which it is found that 77.8% is influential to the same.

51.7% of dentists assert that eco-friendly practices influence on providing low operating and maintenance costs but only 18.3% of dentists agreed that green practice will decrease financial burden which was found to statistically significant. This paradoxical perception of the dentists reveal unfamiliarity towards green dentistry.

Present study results revealed a low level of implementation of amalgam management strategies; this could result from the high use of alternative restoration materials 98(81.7%) and therefore represents a low need for amalgam waste management which is similar to the study conducted by Chopra and Raju, 2017⁹ where 98% of practitioners are implementing alternative to amalgam restoration practices. The use of pre-capsulated alloys in different sizes was low 2(1.7%) among the participants. This finding is contradictory to that of Sawair et al, 2010¹⁰ who found that about 76% of Jordanian general dental practitioners use amalgam capsules of different sizes and also conflicting to the study conducted by Al Shatrat et al, 2013¹ where there is high (68%) usage of amalgam capsules of different sizes.

Present study results illustrated that 110(91.7%) dentists used digital radiography which is in contrary to the study conducted by Sen et al, 2017⁶ where only 40.3% are using digital radiography. High percentage of usage of digital radiography might be because dental professionals may find digital radiography convenient since working hours decrease and image diagnosis could be done in a better fashion.

Previous studies showed that 78.7 % (Al Shatrat et al, 2013)¹, 62% (Chopra and Raju, 2017)⁹, 49% (Sen et al, 2017)⁶ used computer based record systems which is not in congruent with the present study where only 12(10%) used the same. Around 32(26.7%) dentists use educational videos to explain the treatment procedures to patients this is similar to that of 20% (Al Shatrat et al, 2013)¹. There is a need for an up-gradation of converting dental practice management from a paper-based record system to a computer-based records system and also using educational videos to explain the treatment procedures which saves time while updating patient's records and also reduces paper waste, reduces the risk of losing patient records in emergencies, such as fires and floods.

Majority of dentists 58(48.3%) prefer using sterilizable instruments, trays and film holding devices, rather than disposable products which is similar to the studies done by Sen et al, 2017 (62.3%)⁶, Chopra and Raju, 2017⁹ (93%), Al Shatrat et al, 2013(54%)¹. Using steam sterilization does not require toxic chemicals, especially when instruments are wrapped with cloth instead of paper/plastic autoclave bag.

A study showed that 89% participants used washable cloth lab coats (Chopra and Raju, 2017)⁹ which is in concordance with the current study results 98(81.7%) but another study (Sawair et al, 2010)¹⁰ uplifted a different view that declared less use of cloth lab coats by dental practitioners. Only 14(11.7%) are using reusable glass/metal cups There is a need for additional equipment's such as special sanitization cycle with dishwasher and also added workforce to accomplish the health requirements in dental clinics which may be a possible reason for such less usage.

In the current study 54(45%) dentists are using LED light bulbs and 36(30%) dentists turn off and unplug all electrical appliances after use which is in contrast with the studies (Chopra and Raju, 2017)⁹ where dentists employed the use of LED light bulbs (91%) and turn off appliances when not is used (96%). Thus it is depicted clearly that dentists of Rajahmundry are lacking the proper implementation of efficient energy management.

Limitations:

Limited data pertaining to one region i.e. Rajahmundry was collected, which was a limitation of the study. Further studies should target larger samples in different parts of the country in order to get more reliable data to generalize the results.

Recommendations:

1. As eco-friendly dentistry is a fresh and emerging concept in the field, the existing dentist population are unaware of the notion. Therefore, special workshops, seminars, and conferences must be conducted in this regard.
2. The future of green dentistry rests in the hands of the younger dental students, there upon the Dental Council of India must include the concept of green dentistry in the existing curriculum to bring out this transformation in the field of dentistry.
3. Special monitoring cells must be assigned to evaluate the implementation of the concept by the dentists on a personal level, and we must take stringent actions for those not abiding the concept.
4. Create special NGOs and/or provide a government subsidy for the pre-existing conventional dental clinics to transform them into green dental offices.
5. Establish an organization regarding Green dentistry such that through their elementary, no-cost "Green Rewards" programme, it can support the sustainability or green initiatives of the members. They can help members save money on services that nearly every business buys- credit card processing, telephone, travel, tech support, office supplies, etc. and they may give back a piece of cost as "Green Rewards" for subsidy such as smart thermostats, LED light bulbs, or sustainable projects. In the long run, the members tell the world about it, and hence the word spreads itself.
6. Promoting research works on the concept and providing grants in this field will further help the cause.

CONCLUSION:

Green dentistry decreases supply costs by integrating dental innovations, and increases productivity by efficient use time, reducing wastage and preventing pollution. Ultimately patients get benefitted by quality treatment with reduction in treatment costs. Current study suggests that implementation strategies of eco-friendly dental practices among the dental practitioners of Rajahmundry is not adequate. Furthermore, proper education through CDE programs, workshops, and seminars can bring a change from conventional dentistry to green dentistry as there is a positive attitude among dental practitioners.

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