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Original Research

Knowledge, Attitude and Practice of green dentistry among dental professionals in Chennai: A Cross-Sectional Study

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Abstract

Background: The increasing environmental burden generated by healthcare systems has brought attention to sustainable clinical practices, including dentistry. Single-use plastics, radiographic chemicals, sterilization materials, and mercury disposal contribute significantly to ecological pollution. Green dentistry aims to minimize environmental impact through waste reduction, resource conservation, and the elimination of toxic materials. Understanding the current awareness and practices among dental professionals is essential for integrating sustainability into routine care.

Aim: To assess the knowledge, attitude, and practices related to green dentistry among dental practitioners in Chennai and identify gaps and opportunities for sustainable adoption.

Materials and Methods: A descriptive, cross-sectional, questionnaire-based study was conducted among 100 dental practitioners in Chennai between July and August 2024. A structured, pre-validated 20-item questionnaire assessing demographic data, awareness, attitudes, and sustainability-related practices was administered online after obtaining informed consent. Data were analyzed using descriptive statistics.

Results: Among the 100 participants, most were aged 20–30 years (50%) and engaged in private practice (73%). Awareness of green dentistry was moderate, with 32% somewhat familiar and 30% familiar with the concept. Implementation lagged behind awareness: only 17% used eco-friendly materials exclusively, 46% adopted LED lighting, and 29% followed biomedical waste disposal protocols. Recycling practices were limited (13%), and composting was negligible (1%). Attitudes were positive, with 65% willing to invest in training and 45% willing to pay a premium for eco-friendly products. Preferred future initiatives included renewable energy use (33%) and eco-friendly office design (26%).

Conclusion: Although awareness and attitudes toward green dentistry were positive among practitioners, the translation of knowledge into practice remains limited. Strengthening training, integrating sustainability into dental curricula, and providing policy-level support may enhance the adoption of eco-friendly dental practices.

Keywords: Green dentistry, Eco-dentistry, Sustainability, Dental practitioners, Waste management, Environmental awareness.

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Introduction

Environmental degradation has emerged as a global concern, with healthcare services being a notable contributor. Reports estimate that healthcare

systems account for nearly 5% of national carbon dioxide emissions and generate up to one-quarter of hazardous waste worldwide [1]. Dentistry contributes substantially through the use of single-use plastics, radiographic chemicals, sterilization pouches, mercury-containing materials, and other disposable items, amounting to millions of units of biomedical and non-biodegradable waste annually [1,4]. This creates a paradox wherein dentistry, despite its central role in promoting health, inadvertently exerts adverse effects on the environment.

Green dentistry, also referred to as eco-dentistry, is an emerging framework that promotes environmentally responsible dental practice by reducing waste, optimizing resource use, and adopting safer, biodegradable alternatives [5,6]. Guiding principles are commonly aligned with the Four Rs—Rethink, Reduce, Reuse, and Recycle—intended to support sustainability in clinical settings. Although several studies have reported positive attitudes toward eco-friendly practices, actual implementation remains inconsistent due to barriers such as inadequate awareness, financial limitations, and lack of structured training [7,8].

Earlier research indicated that while a proportion of practitioners were aware of carbon footprint concepts, only a smaller percentage actively monitored or reduced their environmental impact [8]. In Chennai, postgraduate practitioners demonstrated exceptionally higher awareness and adoption of eco-friendly practices compared to undergraduates, highlighting existing disparities in exposure and training [9]. Despite global and regional recognition of the need for sustainable practice models, green dentistry remains in its early stages due to infrastructural challenges, limited educational emphasis, and resource constraints [2,10].

Given the growing relevance of sustainability and the environmental impact of dental care, it becomes essential to evaluate practitioners' awareness and adoption of eco-friendly practices. Hence, this study aimed to assess the knowledge, attitude, and practice of green dentistry among dental professionals in Chennai and to identify existing gaps and opportunities for promoting sustainability in routine dental care.

Methodology

A descriptive cross-sectional, multi-institutional questionnaire-based study was conducted among dental practitioners in Chennai from July to August 2024. A structured questionnaire, designed in English, consisted of 20 items—five assessing demographics and fifteen assessing knowledge, attitudes, and practices related to green dentistry.

Questionnaire Validation

The tool underwent face validation by three subject experts in Public Health Dentistry and was pilot-tested among 10 practitioners to ensure clarity and reliability. Required modifications were incorporated before final administration.

Study Population and Sampling

A minimum sample size of 100 was calculated assuming an expected awareness proportion of 28%, a 95% confidence interval, and 5% precision. Convenience sampling was used to recruit dental practitioners actively involved in clinical practice or academics. Practitioners who did not consent or submitted incomplete responses were excluded.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of Sathyabama Dental College and Hospital. Participation was voluntary, and confidentiality was assured.

Data Collection and Analysis

The questionnaire was distributed digitally through online platforms. Responses were compiled using Microsoft Excel 2016 and analyzed using descriptive statistics expressed as frequencies and percentages.

Results

A total of 100 dental practitioners were included in the study. Majority of participants were among 20-30 years age group (50%), followed by 31–40 years (31%) and 41–50 years (17%). Majority of the participants were female (60%) compared to males (30%) and others (1%). About 52% had 0-5 years of clinical experience, 30% had 6-10 years and 17% had 11-15 years. Majority of them had private practice (73%) while 8% were in academic institutions and 8% in group practice. (Table 1)

Regarding awareness, 32% of the participants were somewhat familiar and 30% reported being familiar with

the concept while 30% remained neutral. A small fraction of them were some what unfamiliar (4%) or very unfamiliar (2%) with the concept. Only 29% of them reported using digital x rays and 27% of them reporting occasional use. Questions regarding Waste management revealed that 44% of them segregated general waste while only 29% followed biomedical waste disposal. Recycling bins were used by 13% of them while composting was negligible (1%). Study found only 17% of dentist use eco-friendly material exclusively while 24% reported use mostly and 31% using them occasionally.

Energy saving practice to use LED was reported by 46% of clinics and amalgam waste handled with separator was reported by 30% of clinics while 36% reported not applicable. Regarding water conservation, 29% used low flow faucets, 27% relied on maintenance to fix leaks, and 22% educated staff. Participation in sustainability program was limited with only 21% certified and 36% expressing interest to participate without certificate. About 65% were willing to invest in training, and 45% expressed readiness to pay a small premium for eco -friendly materials. Encouragingly, 34% were likely and 28% very likely to participate in community programs promoting sustainability. Among additional measured preferred for adoption, renewable energy sources (33%), eco-friendly office design (26%) and educational / awareness programs (24%) were preferred. (Table 2)

Variable	Category	Frequency (n)	Percentage (%)
Age	20–30 yrs	50	50%
	31–40 yrs	31	31%
	41–50 yrs	17	17%
	51–60 yrs	2	2%
	> 61 yrs	0	0%
Gender	Male	39	39%
	Female	60	60%
	Others	1	1%
Years in Practice	0–5 yrs	52	52%
	6–10 yrs	30	30%
	11–15 yrs	17	17%
	16–20 yrs	1	1%
	> 21 yrs	0	0%
Type of Practice	Private practice	73	73%
	Group practice	8	8%
	Academic institution	8	8%
	Hospital-based practice	11	11%
	Others	0	0%

Table 1: Demographic Characteristics of the Study Participants

Discussion

This study evaluated the knowledge, attitudes, and practices of dental practitioners in Chennai regarding green dentistry. Most participants belonged to the 20 –30-year age group and predominantly engaged in private practice. Although awareness of eco-friendly practices was moderate, the transition from knowledge to actual implementation was limited. Only 17% of practitioners exclusively used eco-friendly dental materials, and 29% adhered to biomedical waste disposal protocols, indicating a substantial gap between awareness and practice.

Our findings align with Sanguida et al., who reported that although a large proportion of dentists were aware of environmental damage, adoption of reusable or eco-friendly alternatives remained inadequate [2]. Similarly, studies conducted in North Gujarat and Navi Mumbai also revealed moderate awareness but implementation, with digital radiography adoption being notably higher than in our study population [7]. This discrepancy may be attributed to differences in cost, infrastructure availability, and institutional support.

Water and energy conservation practices also showed variability. While 29% used low-flow faucets, only 27% relied on maintenance to prevent water wastage. In contrast, a study in Chennai reported higher adoption of water faucet sensors in clinical settings [9]. Limited adoption of renewable energy and sustainable architectural

Question	Response Option	Frequency	Percentage
Awareness of Eco-friendly Practices			
How familiar are you with the concept of eco-friendly or green dentistry?	Very familiar	30	30%
	Somewhat familiar	32	32%
	Neutral	32	32%
	Somewhat unfamiliar	4	4%
	Very unfamiliar	2	2%
Do you believe that eco-friendly practices are important in dental care?	Strongly agree	33	33%
	Agree	47	47%
	Neutral	19	19%
	Disagree	1	1%
	Strongly disagree	0	0%
Current Implementation of Sustainable measures			
How often does your practice conduct an environmental impact assessment?	Regularly (at least once a year)	34	34%
	Occasionally (every 2-3 years)	47	47%
	Rarely (less than every 2-3 years)	15	15%
	Never	4	4%
Do you use digital impressions instead of traditional molds to reduce material waste?	Always	29	29%
	Often	20	20%
	Sometimes	27	27%
	Rarely	17	17%
	Never	7	7%
What type of waste segregation system is in place in your dental clinic?	General waste	44	44%
	Biomedical waste	29	29%
	Hazardous waste	9	9%
	Recycling bins (paper/plastic/metal)	13	13%
	Composting of organic waste	1	1%
Are eco-friendly dental products and materials used in your practice?	Exclusively	17	17%
	Mostly	24	24%
	Occasionally	31	31%
	Rarely	24	23%
	Never	5	5%
Does your practice implement any of the following energy saving measures?	LED lighting	46	46%
	Motion sensor lighting	18	18%
	Energy-efficient HVAC system	9	9%
	Use of natural lighting	18	18%
	Timers for electrical appliances	8	8%
	Others	1	1%
How does your practice handle the disposal of dental amalgam waste?	Amalgam separator	30	30%
	Special disposal service	18	18%
	Regular waste	14	14%
	Not applicable	36	36%
	Others	2	2%
What steps does your practice take to reduce water consumption?	Low flow faucets	29	29%
	Water-efficient sterilizers	14	14%
	Waterless vacuum systems	6	6%
	Regular maintenance to fix leaks	27	27%
	Educating staff on water conservation	22	22%
Does your practice participate in any environmental sustainability certifications or programs?	Yes, certified	21	21%
	No, in process of certification	21	21%
	No, but interested	36	36%
	No, not interested	22	22%

Willingness to Adopt Green Dentistry Initiatives			
Are you willing to invest in training and education on eco -friendly dental practices?	Yes	65	65%
	No	10	10%
	Maybe	25	25%
Would you be willing to pay a premium for eco-friendly dental products and materials?	Yes, definitely	29	29%
	Yes, but only a small premium	45	45%
	No	4	4%
	Unsure	22	22%
How likely are you to participate in community or professional programs promoting environmental sustainability in dentistry?	Very likely	28	28%
	Likely	34	34%
	Neutral	26	26%
	Unlikely	10	10%
	Very unlikely	2	2%
What additional measures would you be interested in implementing to promote sustainability in your practice?	Renewable energy sources	33	33%
	Eco-friendly office design and construction	26	26%
	Sustainable dental product procurement	11	11%
	Carbon offset programs	4	4%
	Education/awareness for staff & patients	24	24%
	Others	2	2%

Table 2: Awareness, Implementation, and Willingness Towards Green Dentistry Among Dental Practitioners

design mirrors findings from other regions where cost and accessibility remain major constraints.

Despite these practical limitations, attitudes toward sustainability were positive. A majority expressed willingness to undergo training and invest in eco-friendly materials. Studies from Pune and Chandigarh similarly reported strong ethical motivation among practitioners to adopt sustainable practices despite logistical challenges [11,6]. Evidence from educational interventions indicates that structured training can significantly improve knowledge and retention related to eco-dentistry [12].

Overall, the study highlights a clear need for structured training programs, curriculum integration, policy incentives, and improved access to cost-effective eco-friendly alternatives to enhance the adoption of sustainable practices in dentistry.

Conclusion

The findings of this study reveal a notable disparity between awareness and actual implementation of green dentistry among dental practitioners in Chennai. While practitioners generally recognize the environmental impact of dentistry and express positive attitudes toward sustainable measures, adoption of eco-friendly practices remains limited. Strengthening institutional frameworks, enhancing educational exposure, and introducing policy-level incentives may facilitate the incorporation of sustainable principles into routine dental care.

Ethics Approval

The study received approval from the Institutional Ethics Committee prior to data collection (Sathyabama University/IHEC/Study No.016).

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Conflict of Interest

The authors declare none.

Author Contributions

Conceptualization, study design, supervision, critical manuscript revision– BP; Data collection, literature review, manuscript drafting-SS; Data collection, data analysis assistance, manuscript drafting-MF; Literature review, drafting and editing of the manuscript-NSS; Data management, preparation of results, manuscript editing-ST; Assistance in interpretation of findings, manuscript review-SVR; All authors reviewed the manuscript and approved the final version for submission.

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