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# Assessment of Awareness and Practice Regarding Green Dentistry Among Dental Students and Professionals in North Gujarat

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## Keywords
Awareness, Green Dentistry, Questionnaire, Dental professionals, Dental practitioners.

## Abstract
Aim: The aim of the present study was to assess the awareness and practice of green dentistry among dental students and dental professionals in North Gujarat. Material and method: This questionnaire based study was carried out by creating 22 self structured questions using Google forms in the North Gujarat and was distributed among 205 participants (dental students and dental professionals). The obtained data was tabulated and analyzed using SPSS Software. Results: Out of 205 participants, 78.4% postgraduates, 66.1% Graduates and 58.5% faculty/private practitioners were aware of the term green dentistry. Conclusion: It was concluded that the younger generation is more aware regarding the environmental friendly dental practice.

## 1. Introduction

In the current situation, when there are an enormous number of dentists practicing, this profession adds a huge metallic load that jeopardizes the environment. This highlights the importance of "Ecofriendly" dentistry.[1] The phrase "Eco-friendly dentistry" was first used by Dr. Malden Kralj, who initiated America's first green dental practice.[2] Eco-friendly dentistry is a type of practice that uses tools and techniques to minimize waste, pollution, energy, and cost. [3] In addition to producing 4.8 million lead sheets, according to Popa D, et al., the average dental practice produces hazardous wastes from radiography and clinics, including chemicals, mercury waste, and chair

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coverings accounting for a total waste of nearly 28 million liters, 3.7 tons, and 680 million, respectively.[4]

Wastes are broadly categorized as general and hazardous waste, including waste from the healthcare industry. General waste is waste that comes primarily from the administrative, housekeeping, and food preparation industries. Hazardous waste constitutes laboratory wastes, bodily fluids, and sharp waste that results from the healthcare delivery process. At the point of generation, both types of trash need to be adequately handled. The WHO estimates that disastrous medical waste accounts for 10 to 25%. The Health Care Waste is capable of transmitting over 30 lethal bloodborne diseases.[2] Dental professionals must be enlightened about eco-friendly dental practices because dentistry is an essential healthcare sector and is also responsible for various healthcare-related hazards globally.[5]

The phrase "green dentistry" and the idea behind it are relatively new in the dental industry. According to its definition, "green dentistry" is "a high-tech approach that reduces the environmental impact of dental practices and encompasses a service model for dentistry that supports and maintains wellness."[4] Green dentistry is beneficial for the patient, the dentist, and also the environment. It includes high-tech advancements, fosters patient well-being, and saves the dentist money and energy. It also contributes to the reduction of waste generation, favoring the environment.[3]

The green color may contribute to improving endurance, stability, and vision. In the marketing of medications and healthcare items, this color signifies safety and is associated with renewal, growth, and hope.[2] The Eco Dentistry Association (EDA), which has trademarked the word Eco-dentistry, utilizes high-tech advances to improve efficiency and efficacy while minimizing waste as well as pollution in the environment. Green dentistry includes high-tech breakthroughs, places emphasis on wellness and integrative practices, lessen waste and pollution, and saves energy, water, and money.[3] The main tenets of a green dentistry practice are water and energy conservation, the use of non-toxic materials, waste reduction, the elimination of dangerous substances that have a detrimental impact on patients and the environment, and the promotion of eco-friendly goods. It is the forthcoming trend.[4]

The field of dentistry utilizes an abundance of resources and has an environmental impact. Dental offices use gallons of water, a significant amount of power, and produce enormous quantities of plastic garbage each year.[4] Additionally, the National Health Service (NHS), the organization offering dental care in England, generated about 675 kilotons of greenhouse gas emissions between 2013 and 2014.[5] Sustainability is currently a crucial factor for all healthcare services as a result of the Climate Change Act (2008), which mandates that the NHS minimizes its greenhouse gas emissions by 80% by 2050 (a target that has recently been changed to net zero).[2]

As green dentistry is the need of the hour, the present study was conducted with the aim to assess the awareness and practice of green dentistry among dental students and dental professionals in North Gujarat.

## 2. Material and Method

**Study design:**

A self-structured questionnaire-based study was conducted on 205 participants in the North Gujarat region to assess the awareness and practice of the concept of green dentistry among dental students and professionals (Table-1). The participants were divided into 3 categories (Undergraduate students, Postgraduate students, and faculty/ private practitioners).

**Selection criteria:**

Dental students and dental professionals from various fields of North Gujarat were included in the study, whereas those who were not willing to participate in the study and had incompletely filled forms were excluded.

**Ethical Clearance:**

Approval from The Institutional Ethics Committee was obtained before conducting the study.

**Data Collection:**

The study consisted of 22 close-ended multiple-choice questions regarding the awareness and implementation of eco-friendly practices in their daily practice. The questions with different options were

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Journal of Coastal Life Medicine

created using Google Forms. Google Forms was shared with the participants, and they were asked to fill out the form.

The responses generated were recorded in a Microsoft Excel sheet and analyzed with the Chi-square test using SPSS Software.

**Statistical analysis:**

**Table 1:** Lists of questions distributed to the participants.

| | |
|---|---|
| *1.* | *Are you aware of green dentistry?* |
| *2.* | *Are you aware about telemedicine?* |
| *3.* | *Is Eco- friendly method followed in your clinic ?* |
| *4.* | *Were you aware that the old and worn out hand instruments can be recycled?* |
| *5.* | *Which type of light is used in your clinic ?* |
| *6.* | *Which is the power source used in your clinic?* |
| *7.* | *Do you use water faucets sensors in your clinic?* |
| *8.* | *Which method do you use for patient documentation?* |
| *9.* | *How do you schedule appointments?* |
| *10.* | *Which type of radiographic technique is used?* |
| *11.* | *If conventional radiographic technique is used, do you recycle the developer and fixer solution?* |
| *12.* | *if conventional technique is used, films are provided in which type of carry bag/ cover?* |
| *13.* | *Which type of restoration would you prefer?* |
| *14.* | *Is it recommended to use amalgam seperator?* |
| *15.* | *How do you practice disposal of mercury waste?* |
| *16.* | *Which type of lab coats and patient drapes is used in your practice?* |
| *17.* | *Which type of impression technique do you follow?* |
| *18.* | *Do you prefer use of motion detectors for room lighting?* |
| *19.* | *Which type of surface disinfectants are used in your daily practice?* |
| *20.* | *What type of flooring would you prefer?* |
| *21.* | *Do you prefer use of indoor plants for better oxygenation?* |

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Journal of Coastal Life Medicine

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|---|---|
| *22.* | *Would you recommend others for the practice of green dentistry?* |

## 3. Results

Out of the total participants, 127 (62%) were undergraduates, 37 (18%) were postgraduates, and 41 (20%) were faculty/ private practitioners. Out of these, awareness of the term green dentistry was higher among postgraduates at 78.4% compared to graduates at 66.1% and faculty/private practitioners at 58.5%. Though the awareness was higher, only 45.9% of postgraduates and 50.4% of undergraduates followed the practice of green dentistry. A high percentage of postgraduate students (75.7%) were aware of telemedicine. (Table-2)

**Table 2:** Awareness regarding green dentistry among participants

| QUESTIONS | Category | Undergraduate% | Postgraduate% | Faculty/ Private practitioner% |
|---|---|---|---|---|
| *Are you aware of green dentistry?* | Yes | 66.1 | 78.4 | 58.5 |
| | No | 33.9 | 21.6 | 41.5 |
| *Are you aware about telemedicine?* | Yes | 45.7 | 75.7 | 56.1 |
| | No | 54.3 | 24.3 | 43.9 |
| *Is Eco- friendly method followed in your clinic ?* | Yes | 50.4 | 45.9 | 36.6 |
| | No | 25.2 | 29.7 | 22 |
| *Were you aware that the old and worn out hand instruments can be recycled?* | Yes | 51.2 | 59.5 | 39 |
| | No | 26.8 | 24.3 | 24.4 |
| *Would you recommend others for the practice of green dentistry?* | Yes | 73.2 | 64.9 | 68.3 |
| | No | 12.6 | 29.7 | 22 |

The use of the digital radiographic technique was reported higher among the faculty/private practitioners (73.2%) than the postgraduates (56.8%) and undergraduates (48.8%). The composite restoration was preferred over amalgam restoration among postgraduates (62.2%) and faculty/private practitioners (56.1%). CAD-CAM/ Digital impression technique was practiced by 45.9% of the postgraduate students and 40.9% of undergraduate students. (Table-3)

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CODEN: JCLMC4
Journal of Coastal Life Medicine

**Table-3:** Practice of green dentistry

| QUESTIONS | Category | Undergraduate% | Postgraduate% | Faculty/ Private practitioner% |
|---|---|---|---|---|
| *Which method do you use for patient documentation?* | Conventional | 44.9 | 56.8 | 24.4 |
| | Digital | 47.2 | 37.8 | 61 |
| *How do you schedule appointments?* | Application/ e-mail | 33.9 | 37.8 | 43.9 |
| | Register | 60.6 | 62.2 | 41.5 |
| *Which type of radiographic technique is used?* | Conventional | 37.8 | 40.5 | 24.4 |
| | Digital | 48.8 | 56.8 | 73.2 |
| *If conventional radiographic technique is used, do you recycle the developer and fixer solution?* | Yes | 52 | 45.9 | 41.5 |
| | No | 29.9 | 48.6 | 36.6 |
| *if conventional technique is used, films are provided in which type of carry bag/ cover?* | Paper cover | 60.6 | 59.5 | 36.6 |
| | Plastic cover | 36.2 | 40.5 | 48.8 |
| *Which type of restoration would you prefer?* | Amalgam | 27.6 | 18.9 | 2.4 |
| | Composite | 49.6 | 62.2 | 56.1 |
| | GIC | 3.9 | 5.4 | 9.8 |
| *Is it recommended to use amalgam seperator?* | Yes | 70.1 | 59.5 | 51.2 |
| | No | 29.9 | 40.5 | 48.8 |
| *How do you practice disposal of mercury waste?* | In Garbage | 55.1 | 54.1 | 61 |
| | In Liquid | 42.5 | 45.9 | 36.6 |
| *Which type of lab coats and patient drapes is used in your practice?* | Disposable | 59.1 | 51.4 | 53.7 |
| | Non-disposable | 35.4 | 45.9 | 31.7 |
| *Which type of impression* | CAD-CAM/ Digital | 40.9 | 45.9 | 22 |

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Journal of Coastal Life Medicine

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| *technique do you follow?* | impression | | | |
| | Material-based impression | 52 | 54.1 | 53.7 |
| *Which type of surface disinfectants are used in your daily practice?* | Natural disinfectants | 59.1 | 48.6 | 31.7 |
| | Chemical disinfectants | 45.7 | 54.1 | 73.2 |

61% of the faculty/private practitioners used LED lights in their clinics, whereas 51.2% of the faculty/private practitioners used generators as their power source. 61% of the faculty/private practitioners used digital methods for patient documentation, whereas 62% of the postgraduates used a register to schedule their appointments rather than e-mails. (Table-4) The use of motion detectors was higher among the faculty/private practitioners (46.3%), whereas only 31.7% used natural disinfectant, and 17.1% used linoleum cork for the practice of green dentistry. (Table-3 and 4).

**Table- 4:** Clinical ambience followed by participants

| QUESTIONS | Category | Undergraduate% | Postgraduate% | Faculty/ Private practitioner% |
|---|---|---|---|---|
| *Which type of light is used in your clinic ?* | Incandescent | 31.5 | 27 | 2.4 |
| | LED | 64.6 | 64.9 | 61 |
| *Which is the power source used in your clinic?* | Generator | 61.4 | 67.6 | 51.2 |
| | Solar | 32.3 | 27 | 12.2 |
| *Do you use water faucets sensors in your clinic?* | Yes | 57.5 | 48.6 | 58.5 |
| | No | 42.5 | 51.4 | 41.5 |
| *Do you prefer use of motion detectors for room lighting?* | Yes | 45.7 | 32.4 | 46.3 |
| | No | 29.9 | 56.8 | 31.7 |
| *What type of flooring would* | Polyvinyl chloride | 66.9 | 59.5 | 46.3 |
| | Vinyl | 22.8 | 18.9 | 46.3 |

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Journal of Coastal Life Medicine

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| *you prefer?* | Linoleum / Cork | 11.8 | 24.3 | 17.1 |
| *Do you prefer use of indoor plants for better oxygenation?* | Yes | 74.8 | 48.6 | 53.7 |
| | No | 10.2 | 45.9 | 36.6 |

## 4. Discussion

In the present study, we included 205 participants. Out of which 127(62%) were undergraduates, 37(18%) were postgraduates and 41(20%) were faculty /private practitioners. Results showed that 78.4% of Postgraduates, 66.1% of Graduates, and 58.5% of faculty/private practitioners were aware of the term green dentistry, and the difference was not statistically significant with the p-value 0.172. This was in contrast with Agrasuta and Nelson [6], where 83.5% of respondents were not aware of "green dentistry," and only 16.5% had an idea about the concept. This contrast could be due to the fact that the referenced study was conducted in 2013, and in the span of 10 years, the trend has changed.

In the current study, out of all the participants, 75.7% of the postgraduate students were aware of telemedicine, followed by the private practitioners and undergraduate students which was 56.1% and 45.7% respectively. Telemedicine is the means of diagnosis or treatment of patients by using telecommunication technology.

In the present study, 65% of the participants preferred the use of LED lights over incandescent lights, whereas 40% of them still use incandescent lights in their practice. The difference was very highly significant. This study was in accordance with Shivangi Verma, et al. [7], where most (75%) of the respondents (dentists) recommended the use of LED lights. Whereas, in the study conducted by Kallakuri, et al. [8], only 45% of the total participants preferred LED lights.

In our study, 61% of the private practitioners used a digital method for patient documentation, which is in accordance with the survey conducted by Pallavi, et al. [2], where 52% of the practitioners preferred a digital method for maintaining patients' records.

In the present study, the use of the digital radiographic technique was practiced by 73.2% of the faculty/ private practitioners, whereas 56.8% of the postgraduate students preferred the use of digital radiography over conventional radiography while only 48.8% of undergraduates practiced it, which was statistically significant (p-value 0.02). This was in accordance with Pallavi, et al. [2], who observed a similar trend with statistical significance (p-value 0.01). Our results were in contrast with Boricha, et al. [3], where it was observed that 64% of private practitioners, 94.8% of interns, and 91% of post-graduate students practiced digital radiography. This contrast may be due to the difference in the population studied. Out of these, those who prefer conventional radiographic techniques, 52%, 45%, and 41% of the undergraduates, postgraduates, and private practitioners, respectively, recycle the developer and fixer solution.

62% of postgraduate students preferred the use of composite restoration, whereas, 56.6% of private practitioners, and 49.1% of undergraduates used composite over amalgam and GIC restorations, the difference observed was statistically very highly significant.

In our study, 45.9% of the postgraduate students and 40.9% of undergraduate students used CAD-CAM or digital impression rather than the material-based technique, which is statistically highly significant. This was in accordance with the study conducted by Boricha, et al.[3], who reported similar findings.

In the present study, 31.7%, 48%, and 59% of private practitioners, postgraduates, and undergraduate students, respectively, used tree oil/ natural

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Journal of Coastal Life Medicine

disinfectant solutions. Linoleum/ cork, which is environment-friendly, was used as flooring by 17.1% of the total participants, which was in accordaance with the study conducted by Chopra and Raju[1], where only 16% of the participants used environment-friendly flooring material.

In our study, we observed that 74.8% of undergraduates, 48.6% of postgraduates, and 53.7% of private practitioners used indoor plants for better oxygenation. This was in accordance with the study held by Boricha, et al.[3], where 72% of the practitioners preferred green plants.

From the current study, it was observed that 73.2% of undergraduates, 64.9% of postgraduates, and 68.3% of the faculty/ private practitioners recommended others for practicing environment-friendly dentistry.

## 5. Conclusion

Based on the observation of the present study, younger generations of students are becoming more aware of the need for environmental friendly dental care. Thus, in order to preserve a healthy environment, it is important to develop awareness campaigns, incorporate green dentistry into the dental teaching curriculum, and practice it on a daily basis.

Therefore, by incorporating it into routine practice, green dentistry can become a viable alternative to traditional dentistry.

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