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Evaluation Of Knowledge, Attitude And Practice About Green Dentistry Before And After AV Intervention. A Quasi Experimental Study

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Abstract
Background*: Dentistry contributes significantly to environmental pollution through the generation of biomedical waste, excessive use of disposable materials, chemical waste, energy consumption, and conventional clinical practices. Green dentistry has emerged as an environmentally sustainable approach aimed at minimizing the ecological footprint of dental practice while maintaining quality patient care. However, awareness and implementation of green dentistry practices among dental professionals remain limited.*
Aim*: To evaluate the knowledge, attitude, and practice regarding green dentistry among dental professionals before and after an audio-visual educational intervention.*
Methodology*: The present quasi-experimental study was conducted among 62 dental professionals. A structured questionnaire was used to assess demographic details along with knowledge, attitude, and practice regarding green dentistry. Baseline assessment was carried out prior to intervention, followed by a structured audio-visual educational program focusing on sustainable dental practices, waste management, and environmentally responsible clinical measures. Post-intervention assessment was conducted using the same questionnaire. Data were entered into Microsoft Excel and analyzed using IBM SPSS version 25.0. Results were expressed as frequencies, percentages, tables, and graphs. Statistical significance was considered at $p < 0.05$.*
Results*: The mean age of participants was 27.10 ± 4.32 years, with 56.5% females and 43.5% males. Significant improvement in knowledge and practice was observed following the intervention. Awareness regarding green dentistry increased from 56.5% to 100%, knowledge regarding digital patient records improved from 43.5% to 98.4%, and willingness to adopt eco-friendly practices increased from 69.4% to 98.4%. Practice-related improvements included digital patient record use from 8.1% to 100%, energy-efficient lighting adoption from 75.8% to 100%, and proper amalgam waste disposal from 74.2% to 100%. Overall good knowledge increased from 0% to 96.8%, while good practice improved from 29.0% to 91.9%, with statistically significant differences ($p < 0.001$).*
Conclusion*: Audio-visual educational intervention was highly effective in significantly improving knowledge, attitude, and practice regarding green dentistry among dental professionals. Structured educational strategies may serve as an effective approach for promoting environmentally sustainable dental practices and encouraging long-term adoption of green dentistry principles.*

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I. Introduction

Dentistry contributes significantly to environmental waste generation due to the use of disposable materials, chemical waste, radiographic materials, water consumption, and energy-intensive equipment. With increasing global awareness about environmental sustainability, the concept of green dentistry has emerged as an approach aimed at reducing the ecological footprint of dental practice while maintaining effective patient care [1]. Green dentistry encourages environmentally responsible measures such as reduction in waste generation, use of digital records and radiography, energy-efficient equipment, eco-friendly materials, and proper biomedical waste disposal [2].

Dental professionals play an important role in adopting sustainable practices because clinical dental settings generate considerable quantities of hazardous and non-hazardous waste daily. Improper disposal of amalgam waste, excessive use of paper-based records, conventional suction systems, and energy-consuming devices contribute to environmental burden [3]. Green dentistry promotes the principles of reduce, reuse, recycle, and rethink, helping improve sustainability in clinical practice [4].

Despite growing awareness globally, knowledge and implementation of green dentistry practices among dental professionals remain limited, particularly in developing countries where environmental policies may not be strictly enforced [5]. Several studies have reported inadequate awareness and inconsistent adoption of eco-friendly dental practices among dentists and dental students, mainly due to barriers such as lack of awareness, cost concerns, limited infrastructure, and insufficient training [6,7].

Educational interventions have shown effectiveness in improving knowledge, attitude, and clinical practices among healthcare professionals. Audio-visual (AV) educational methods provide an engaging and effective means of delivering structured information, improving retention and understanding [8]. However, studies evaluating the impact of AV intervention specifically on knowledge, attitude, and practice regarding green dentistry remain limited.

Therefore, the present quasi-experimental study was undertaken to evaluate the knowledge, attitude, and practice regarding green dentistry among dental professionals before and after audio-visual intervention.

II. Methodology

The present quasi-experimental study was conducted among dental professionals to evaluate their knowledge, attitude, and practice regarding green dentistry before and after audio-visual intervention. The study population included dental professionals who were willing to participate and provided informed consent. Participants who were unavailable during the intervention or submitted incomplete responses were excluded from the study.

A structured self-administered questionnaire was used for data collection. The questionnaire consisted of demographic details including age and gender, along with questions assessing knowledge, attitude, and practice related to green dentistry. Knowledge-based questions assessed awareness regarding green dentistry concepts, environmental impact of dental practices, contributors to pollution, and barriers to adoption, while practice-based questions evaluated eco-friendly practices such as use of digital records, energy-efficient lighting, proper waste disposal, and environmentally sustainable clinic measures.

Baseline data were collected prior to the intervention using the questionnaire. Following this, participants were exposed to an audio-visual educational intervention designed to improve awareness and understanding of green dentistry concepts and sustainable clinical practices. The AV intervention included structured educational content focusing on environmental sustainability in dentistry, eco-friendly alternatives, waste management, and practical implementation of green dentistry principle. The study included an educational program delivered through a PowerPoint presentation designed to promote awareness of green dentistry among dental practitioners. The presentation included topics such as the definition and significance of green dentistry, the 4Rs principle, environmental consequences of routine dental practices, and the benefits of implementing sustainable and eco-friendly measures in dentistry. Participants were followed up after one month using a post-intervention questionnaire to assess the effectiveness of the educational program in improving knowledge and practices related to green dentistry.

Statistical Analysis

Post-intervention assessment was carried out after 1 month using the same questionnaire to evaluate changes in knowledge, attitude, and practice following the intervention. Data obtained were entered into Microsoft Excel and statistically analyzed using IBM SPSS software version 25.0. Results were expressed in the form of frequencies, percentages, tables, and graphs. Comparison between pre-intervention and post-intervention responses was performed using appropriate statistical tests, and a p-value of less than 0.05 was considered statistically significant.

III. Result

A total of 62 participants were included in the study. The mean age of the participants was 27.10 ± 4.32 years. Among the participants, 56.5% were females and 43.5% were males, indicating a slightly higher female representation in the study population.

Table 1. Demographic Characteristics of the Study Participants

Variable	Category	Value
Age (years)	Mean ± SD	27.10 ± 4.32
Gender	Male	27 (43.5%)
	Female	35 (56.5%)

Mean ± SD = Mean and standard deviation of age of participants.

Regarding knowledge related to green dentistry, a significant improvement was observed following the educational intervention. Awareness about green dentistry increased from 56.5% in the pre-intervention phase to 100% post-intervention. Knowledge that green dentistry primarily focuses on reducing environmental impact

improved from 80.6% to 100%, while recognition of major contributors to environmental pollution in dentistry increased from 59.7% to 100%. Awareness regarding digital patient records as an environmentally sustainable approach improved substantially from 43.5% to 98.4%, and knowledge regarding the contribution of conventional vacuum saliva ejector systems to pollution increased from 48.4% to 87.1%. Participants expressing willingness to adopt eco-friendly practices increased from 69.4% pre-intervention to 98.4% post-intervention. Overall, good knowledge increased from 0% before intervention to 96.8% after intervention, while poor knowledge reduced from 33.9% to 0%, with the difference being statistically significant ($p < 0.001$).

Table 2. Knowledge Regarding Green Dentistry Before and After Intervention

Knowledge Questions	Pre-intervention (%)	Post-intervention (%)	p-value
Awareness about Green Dentistry	35 (56.5%)	62 (100%)	<0.001*
Green dentistry reduces environmental impact	50 (80.6%)	62 (100%)	<0.001*
Major contributors to environmental pollution in dentistry	37 (59.7%)	62 (100%)	<0.001*
Digital patient records help reduce environmental harm	27 (43.5%)	61 (98.4%)	<0.001*
Conventional vacuum saliva ejector contributes to pollution	30 (48.4%)	54 (87.1%)	<0.001*
Willingness to adopt eco-friendly practices	43 (69.4%)	61 (98.4%)	<0.001*
Cost as major barrier to green dentistry adoption	26 (41.9%)	45 (72.6%)	0.002*

Table. 3 Overall Knowledge Score

Knowledge Category	Pre-intervention (%)	Post-intervention (%)	P value
Poor knowledge (<50%)	21 (33.9%)	0 (0%)	<0.005
Fair knowledge (50–75%)	41 (66.1%)	2 (3.2%)	
Good knowledge (>75%)	0 (0%)	60 (96.8%)	

p-value = Comparison between pre-intervention and post-intervention knowledge responses; Knowledge score was categorized as poor (<50%), fair (50–75%), and good (>75%); statistically significant at $p < 0.05$.

Similarly, significant improvement was observed in green dentistry practices following the intervention. Preference for eco-friendly flooring materials increased from 75.8% to 91.9%. The use of fully digital patient record systems improved markedly from 8.1% pre-intervention to 100% post-intervention. Adoption of energy-efficient LED lighting increased from 75.8% to 100%, while proper amalgam waste disposal practices also improved from 74.2% to 100%. Regular use of natural disinfectants increased from 50.0% to 83.9% after the intervention. Overall, participants demonstrating good practice increased from 29.0% before intervention to 91.9% after intervention, whereas poor practice reduced from 35.5% to 0%, showing statistically significant improvement ($p < 0.001$).

Table 4. Practice Regarding Green Dentistry Before and After Intervention

Practice Questions	Pre-intervention (%)	Post-intervention (%)	p-value
Q6. Preference for eco-friendly flooring material	47 (75.8%)	57 (91.9%)	0.012*
Q7. Use of fully digital patient record system	5 (8.1%)	62 (100%)	<0.001*
Q8. Use of energy-efficient lighting (LED bulbs)	47 (75.8%)	62 (100%)	<0.001*
Q9. Proper amalgam waste disposal	46 (74.2%)	62 (100%)	<0.001*
Q10. Regular use of natural disinfectants	31 (50.0%)	52 (83.9%)	<0.001*

Table 5. Overall Practice Score

Practice Category	Pre-intervention (%)	Post-intervention (%)	P value
Poor practice (<50%)	22 (35.5%)	0 (0%)	0.002
Fair practice (50–75%)	22 (35.5%)	5 (8.1%)	
Good practice (>75%)	18 (29.0%)	57 (91.9%)	

p-value = Comparison between pre-intervention and post-intervention practice responses; Practice score was categorized as poor (<50%), fair (50–75%), and good (>75%); statistically significant at $p < 0.05$.

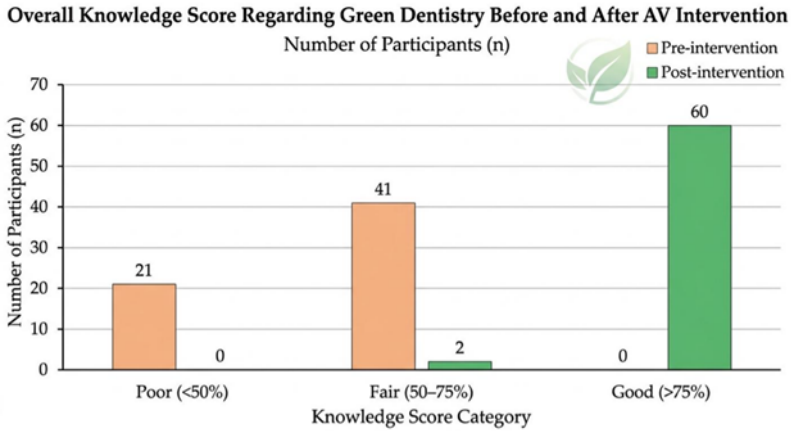

Figure 1. Distribution of Overall Knowledge Scores Regarding Green Dentistry Among Dental Professionals Before and After Audio-Visual Intervention.

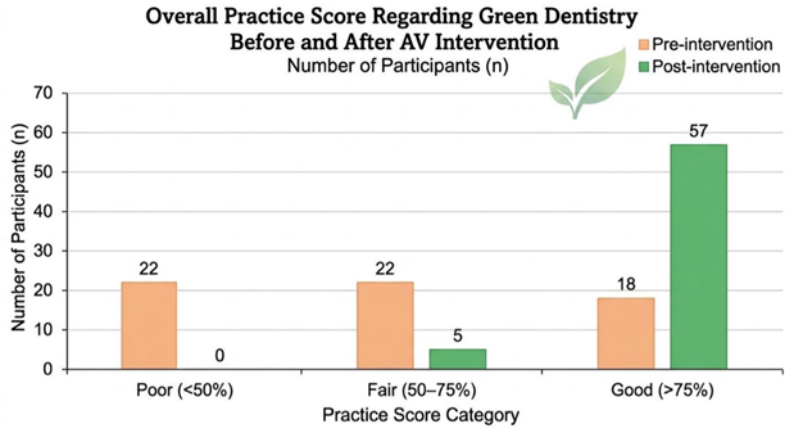

Figure 2. Distribution of Overall Practice Scores Regarding Green Dentistry Among Dental Professionals Before and After Audio-Visual Intervention.

IV. Discussion

The present quasi-experimental study assessed the effectiveness of an audio-visual educational intervention in improving knowledge, attitude, and practice regarding green dentistry among dental professionals. The findings demonstrated substantial improvement following the intervention, indicating that structured educational methods can significantly influence awareness and environmentally sustainable clinical behavior.

Awareness regarding green dentistry increased markedly from 56.5% before intervention to 100% after intervention, reflecting considerable improvement in participants' baseline understanding of sustainable dentistry concepts. Similar findings were reported by Verma et al., who observed moderate awareness among dental professionals, although practical understanding and implementation remained limited (9). Zia et al. also reported that while dental practitioners demonstrated awareness regarding environmental sustainability, actual adoption of green practices remained inconsistent (10). Compared to these findings, the present study demonstrated stronger immediate improvement, likely due to the direct educational reinforcement provided through the AV intervention.

Knowledge regarding specific sustainable practices also improved significantly. Awareness about digital patient record systems as an environmentally responsible alternative increased from 43.5% to 98.4%, while understanding regarding environmental pollution caused by conventional vacuum suction systems improved from 48.4% to 87.1%. Hassan et al. similarly reported significant improvement in knowledge and eco-friendly clinical awareness among intern dentists following an environmental educational intervention, supporting the effectiveness of structured educational approaches in promoting sustainable dental practices (11).

A positive attitudinal shift was also evident in the present study, as willingness to adopt eco-friendly practices increased from 69.4% pre-intervention to 98.4% post-intervention. Nagarale et al. reported similarly favorable attitudes toward green dentistry among dental professionals in Pune, although practical implementation remained lower than expected (12). This suggests that while positive perception may already exist among dental professionals, structured educational exposure may help convert intention into practical readiness.

An important finding in the present study was the increased recognition of cost as a barrier to implementing green dentistry, which rose from 41.9% before intervention to 72.6% after intervention. This

suggests that greater awareness may also improve understanding of real-world implementation challenges. Jampani et al. highlighted that although green dentistry offers substantial long-term environmental benefits, initial infrastructure investment and financial constraints may limit immediate adoption in routine practice (13). Similar concerns have also been reported in broader sustainability discussions within oral healthcare (14).

Practice-related improvements were particularly notable following the intervention. The use of fully digital patient record systems improved dramatically from 8.1% to 100%, adoption of energy-efficient LED lighting increased from 75.8% to 100%, proper amalgam waste disposal improved from 74.2% to 100%, and regular use of natural disinfectants increased from 50.0% to 83.9%. Rastogi et al. emphasized that relatively simple modifications in routine dental practice can significantly reduce environmental burden without compromising treatment quality (15). Similarly, Martin and Mulligan highlighted that environmental sustainability in oral healthcare can be achieved through quality-driven practical modifications in clinical workflow (16).

The improvement in proper amalgam waste disposal is particularly important due to its environmental implications, especially mercury contamination and biomedical waste burden. The FDI World Dental Federation emphasized sustainable waste management as a critical component of eco-friendly dentistry (17). Broader healthcare sustainability literature has similarly highlighted the importance of responsible waste handling and carbon-conscious clinical systems in minimizing environmental impact (18).

The most substantial improvements in the present study were observed in the overall scoring categories. Good knowledge increased from 0% pre-intervention to 96.8% post-intervention, while poor knowledge reduced completely from 33.9% to 0%. Similarly, good practice improved significantly from 29.0% to 91.9%, with poor practice reducing from 35.5% to 0%. Duane et al. reported that sustainable modifications in dental systems can meaningfully reduce environmental burden and carbon emissions when integrated into practice (19). These findings support the present results and reinforce the role of education in promoting sustainable professional behavior.

The effectiveness of audio-visual educational intervention observed in this study aligns with broader educational evidence supporting active learning methods for improving healthcare knowledge retention and behavioral change. Aminoshariae and Kulild suggested that evidence-based environmentally responsible approaches in dentistry require both awareness and practical implementation support for successful adoption (20).

However, certain limitations should be acknowledged. The study involved a relatively small sample size, and post-intervention assessment was conducted one month after the educational session, limiting evaluation of long-term retention and sustainability of behavioral change. Additionally, self-reported responses may have introduced response bias.

Within these limitations, the present study demonstrates that audio-visual educational intervention is an effective strategy for significantly improving knowledge, attitude, and practice regarding green dentistry among dental professionals and may serve as a practical approach for promoting environmentally sustainable oral healthcare.

The present study demonstrates that audio-visual educational intervention produced strong improvements, with several knowledge and practice parameters increasing to **80–100% post-intervention**, highlighting its effectiveness as a practical educational strategy for promoting green dentistry among dental professionals.

V. Conclusion

Within the limitations of the present study, it can be concluded that the audio-visual educational intervention was highly effective in significantly improving the knowledge, attitude, and practice regarding green dentistry among dental professionals. Marked post-intervention improvement was observed across nearly all assessed parameters, with several responses increasing from moderate baseline levels to 80–100% after the intervention. Overall good knowledge increased remarkably from 0% pre-intervention to 96.8% post-intervention, while good practice improved from 29.0% to 91.9%, clearly demonstrating the effectiveness of the educational approach.

The findings indicate that inadequate awareness and limited exposure to sustainable dental concepts may be major barriers to the adoption of green dentistry practices. The study highlights that simple, structured educational interventions can successfully influence professional behavior and encourage environmentally responsible clinical practices. Incorporating green dentistry principles into undergraduate dental education, continuing professional training programs, and institutional clinical protocols may help ensure sustained implementation of eco-friendly practices, ultimately contributing to environmentally sustainable oral healthcare.

Future research should focus on larger multicentric studies with longer follow-up periods to assess long-term retention of knowledge and sustained behavioral changes following educational interventions. Further studies may also evaluate the practical feasibility, cost-effectiveness, and barriers to integrating green dentistry practices into routine clinical settings, which may help in developing stronger policies and sustainable strategies for environmentally responsible dental healthcare.

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