The Academic
International Journal of Multidisciplinary Research

An Online Peer Reviewed / Refereed Journal
Volume 3 | Issue 7 | July 2025
ISSN: 2583-973X (Online)
Website: www.theacademic.in

Sustainable Endodontic Practices: A Step towards a Greener Future

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DOI : https://doi.org/10.5281/zenodo.16870868

ARTICLE DETAILS

Research Paper

Accepted: 27-07-2025

Published: 10-08-2025

Keywords:

Sustainable endodontics, eco-friendly dentistry, environmental impact, waste reduction, energy efficiency.

ABSTRACT

Backround: The best environmental footprint in the dental industry is a growing concern, with endodontics contributing to waste generation and energy consumption in day-to-day dental clinical practices (Duane et al., 2020; Mulimani, 2017). Objectives: The present detailed review aims to explore sustainable endodontic practices, highlighting eco-friendly materials, waste reduction strategies, and energy-efficient practices (Rupa KR et al., 2015; Velaparambil & Gupta, 2023). Methodology: A comprehensive review of existing literature was conducted, analyzing studies on sustainable endodontic practices (Sant et al., 2025). Results: Review findings indicate that environmentally friendly dentistry is achievable through sustainable endodontic practices, which decrease the harm to the environment (Pulyodan et al., 2020). The main conclusions are the advantages of sustainable materials, waste minimization solutions, and energy-saving activities (Rathakrishnan & Priyadarhini, 2017; Thakar et al., 2023). Conclusion: An environmentally friendly endodontic approach is important to prevent the environmental impact created by dental treatment. This gives dentists the opportunity perform their clinical dental practices in a sustainable way by following eco firendly practice of using biocompatible and recyclable materials, practicing office waste reduction policies (such as paper recycling), reducing energy use

during routine work processes(Mohelay et al., 2016).

Introduction :

As the world grapples with the challenges of climatic changes, environmental degradation, global warming, and sustainability (IPCC, 2021), the dental industry is also taking steps to reduce its ecological footprint (Duane et al., 2020).

Endodontics, a specialized branch of dentistry dealing with the diagnosis, treatment, and management of diseases affecting the dental pulp and surrounding tissues (American Association of Endodontists, n.d.), is no exception.

Sustainable endodontic practices are crucial for reducing the environmental impact of dental procedures and promoting eco-friendly dentistry (Rupa KR et al., 2015).

The Environmental Impact of Endodontics : Endodontic procedures, like other dental treatments, generate waste, consume energy, and utilize materials that can harm the environment (Mulimani, 2017). The use of disposable non-degradable instruments, gloves, and other single-use plastic products contributes to the growing problem of medical waste (Velaparambil & Gupta, 2023). Moreover, the energy consumption of dental equipment, such as endodontic motors and ultrasonic devices, adds to the overall carbon footprint of dental practices (Sant et al., 2025).

The dental industry's environmental footprint is a growing concern, with endodontics contributing to waste generation and energy consumption in day-to-day clinical practices (Mulimani, 2017). Sustainable endodontic practices are crucial for reducing the environmental impact of dental procedures and promoting eco-friendly dentistry (Rupa KR et al., 2015).

Sustainable Practices in Endodontics: Fortunately, there are several ways to make endodontic practices more sustainable. Some of these include:

1. Using eco-friendly materials: Biodegradable composites, recycled materials, and natural resins can reduce landfill contributions and minimize environmental harm (Rathakrishnan and Priyadarhini, 2017).

2. Reducing waste: Implementing digital records, recycling programs, and proper waste segregation can significantly reduce waste generation (Mohelay et al., 2016).

3. Energy efficiency: Investing in energy-efficient equipment development, using LED lighting, and optimizing scheduling can minimize energy consumption (Thakar et al., 2023).

4. Sustainable sterilization methods: Adopting eco-friendly sterilization methods, such as steam sterilization, can reduce the environmental impact of dental practices (K R R, Chatra L, et al., 2015).

Benefits of Sustainable Endodontic Practices: The benefits of sustainable endodontic practices extend beyond environmental sustainability. Some of the advantages include:

1. Cost savings: Sustainable materials and practices can lead to long-term cost savings (Velaparambil and Gupta, 2023).

2. Enhanced patient trust: Patients prefer practices that prioritize sustainability, leading to increased loyalty and trust (Sant et al., 2025).

3. Regulatory compliance: Adopting sustainable practices helps dental professionals stay ahead of environmental regulations (Rathakrishnan and Priyadarhini, 2017).

Future of Sustainable Endodontics: The endodontic field is dynamic; therefore, the innovations in sustainable practices are not an exception. The recent developments have been as follows:

1. Utilization of biodegradable material: Researchers are examining the structure such as biodegradable endodontic material that can help to form pulp-dentin with lower carbon footprints (Pulyodan et al., 2020).

2. Digital dentistry: A reduction in waste and increase in accuracy of endodontic procedures may be achieved through Digital Dentistry (Digital radiography and 3D printing) (Thakar et al., 2023).

Methods and Methodology :

To investigate sustainable endodontic practices, a comprehensive review of existing literature was conducted (Duane et al., 2020; Mulimani, 2017). The methodology involved:

1.Literature Search: A thorough search of peer-reviewed articles, journals, and books was performed using relevant keywords, such as "sustainable endodontics," "eco-friendly dentistry," and "environmental impact of endodontics" (Rupa et al., 2015; Velaparambil and Gupta, 2023).

2. Inclusion and Exclusion Criteria*: Studies were selected based on their relevance to sustainable endodontic practices, publication in reputable journals, and availability of full-text articles (Sant et al., 2025).

3. Data Extraction: Relevant data were extracted from the selected studies, including information on sustainable materials, waste reduction strategies, and energy-efficient practices in endodontics (Pulyodan et al., 2020; Rathakrishnan and Priyadarhini, 2017).

4. Analysis and Synthesis: The extracted data were analyzed and synthesized to identify common themes, trends, and best practices in sustainable endodontics (Thakar et al., 2023). This methodology allowed for a comprehensive understanding of sustainable endodontic practices and their potential benefits for the environment, patients, and dental professionals.

Table 1: A list of the chosen articles in the review.

SL NO:	Topic	Type of articles	Author	Publication	Year
1.	Eco-friendly dentistry: not a matter of choice	Review	Adams E.[15]	Journal of the Canadian Dental Association	2007
2.	Go green dentistry	Review	Passi S and Bhalla S.[16]	Journal of Education and Ethics in Dentistry Community health	2012
3.	Going green with eco-friendly dentistry	Review	Avinash B., et al.[17]	The Journal of Contemporary Dental Practice	2013
4.	Eco-dentistry: the environment friendly Dentistry	Review	Chopra, et al.[18]	Saudi Journal for Health Sciences	2014
5.	Green dentistry:A metamorphosis	A short communication study	Rastogi V., et al.[19]	Journal of Clinical and Diagnostic Research	2014

	towards an eco-friendly dentistry:				
6.	Green dentistry: the future	Review	Rathakrishnan M and Priyadarhini A.[12]	Journal of the International Clinical Dental Research Organization	20
7.	Green dentistry: the art and science of sustainable practice	Review	Mulimani P.[3]	British Dental Journal	20
8.	Eco-friendly dentistry: preventing pollution to promoting sustainability	Review	Mittal, et al.[20]	Indian Journal of Dental Sciences	20
9.	Green dentistry: the new norm	Review	Velaparambi R and Gupta S.[10]	Journal of Oral Health and Community Dentistry	20
10.	Eco-dentistry: Sustainable practices for healthier life and a greener planet.	Review	Sant I, Tripathi P, Chandra S, Sinha S. (11)	Asian J Oral Health Allied Sci.	20

Results :

The review of sustainable endodontic practices revealed several key findings:

1. Eco-friendly materials: Biodegradable composites, recycled materials, and natural resins can reduce environmental harm and promote sustainability (Rupa et al., 2015; Velaparambil and Gupta, 2023).

2. Waste reduction strategies: Digital records, recycling programs, and proper waste segregation can significantly reduce waste generation (Duane et al., 2020; Mulimani, 2017).

3. Energy-efficient practices: Energy-efficient equipment, LED lighting, and optimized scheduling can minimize energy consumption (Sant et al., 2025; Thakar et al., 2023).

4. Benefits: Sustainable endodontic practices can lead to cost savings, enhanced patient trust, and regulatory compliance (Rathakrishnan and Priyadarhini, 2017; Pulyodan et al., 2020).These results highlight the potential for sustainable endodontic practices to reduce environmental impact while promoting eco-friendly dentistry (Mohelay et al., 2016). Sustainable endodontic practices are crucial for reducing waste, conserving resources, and minimizing pollution (Velaparambil and Gupta, 2023).

Discussion :

The findings of this review highlight the importance of sustainable endodontic practices in reducing the environmental impact of dental procedures (Duane et al., 2020; Mulimani, 2017). The use of eco-friendly materials, waste reduction strategies, and energy-efficient practices can significantly contribute to a more sustainable dental industry (Rupa et al., 2015; Velaparambil and Gupta, 2023).

Implications for Practice:

1. Adoption of sustainable materials: Dental professionals can adopt eco-friendly materials, such as biodegradable composites and recycled materials, in their practice (Pulyodan et al., 2020; Rathakrishnan and Priyadarhini, 2017).

2. Implementation of waste reduction strategies: Dental practices can implement waste reduction strategies, such as digital records and recycling programs, to minimize waste generation (Mohelay et al., 2016).

3. Energy-efficient practices: Dental professionals can optimize their energy consumption by using energy-efficient equipment and LED lighting (Sant et al., 2025; Thakar et al., 2023).

Future Directions:

1. Research and development: Further research is needed to develop new sustainable materials and practices in endodontics (Velaparambil and Gupta, 2023).

2. Education and training: Dental professionals should receive education and training on sustainable practices to promote their adoption (Rathakrishnan and Priyadarhini, 2017).

3. Policy and regulation: Policy makers and regulatory bodies should support the adoption of sustainable practices in dentistry through guidelines and incentives (Duane et al., 2020).

By adopting sustainable endodontic practices, dental professionals can contribute to a more environmentally friendly and responsible dental industry (Rupa et al., 2015). The dental industry's environmental footprint is a growing concern, with endodontics being a significant contributor (Mulimani, 2017).

This article explores the importance of sustainability in endodontics, highlighting eco-friendly materials, waste reduction strategies, and energy-efficient practices (Sant et al., 2025). By adopting sustainable approaches, dental professionals can promote environmental responsibility while enhancing patient care and trust (Thakar et al., 2023).

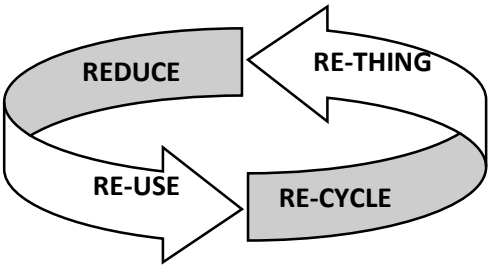

Figure : 4 R's in eco-green

Conclusion: To achieve more environmentally friendly dentistry, sustainable endodontic practices have been required to lessen the extent of the environmental influence of any of the dental initiatives and to support eco-friendly dentistry. Dentists can assist in developing a more eco friendly future supplied by utilizing eco friendly material, waste reducing and maximum usage of the energy. With dental business basking off the change, it is pertinent to learn that sustainability should be a priority and therefore there is a sustainable environment to look upon in future generations.

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