

Toward Sustainable Dental Practice: Comprehensive Guide and Application

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Abstract

Introduction:

Green dentistry (or eco-dentistry) is an approach to dental care that minimizes environmental impact through:

- Waste reduction (eliminating single-use plastics, mercury, and toxic chemicals)
- Resource conservation (saving water and energy)
- Biodegradable/eco-friendly materials (replacing conventional products)
- Carbon footprint reduction (renewable energy, sustainable practices)

It merges clinical excellence with environmental responsibility, ensuring patient care doesn't come at the planet's expense.

Health Risks:

- Mercury exposure → neurotoxicity, kidney damage.
- PVC-based disposables → carcinogenic when incinerated.
- Chemical disinfectants → water contamination.

Objectives:

Reduce Environmental Impact of Traditional Dentistry:

- Mercury Pollution: Dental amalgam is the #1 source of mercury in wastewater. (340 tons/year globally, WHO).
- Plastic Waste: A single dental clinic discards ~500kg of plastic annually.
- Water Waste: Conventional vacuum systems use ~1,000 gallons/day/clinic.
- Energy Use: Autoclaves and lights consume 30% more energy than necessary.

Principles:

Principles	Traditional Practice	Green Alternative
Mercury-Free	Amalgam fillings	Bioactive composites
Plastic-Free	Disposable tips/gloves	Reusable stainless steel/silicone tools
Digital Workflow	PVS impressions	Intraoral scanners
Energy Efficiency	Halogen lights	LED operatory lights
Water Conservation	Wet vacuum systems	Dry vacuum systems (saves 1M gallons/year)
Non-Toxic Sterilization	Chemical disinfectants	UV-C light or steam sterilization

Green Dental Technologies:

A. Mercury Alternatives:

- Bioactive fillings: Releases calcium/fluoride, mimics natural teeth.
- Glass ionomer cements: Chemical-bonded, fluoride-releasing, no mercury.

B. Zero-Waste Sterilization, by:

- Reusable stainless steel cassettes (replace disposable wraps).
- Autoclavable silicone suction tips (instead of PVC).

C. Sustainable Clinics:

- Solar-powered offices.
- 3D-printed biodegradable surgical guides (plant-based resins).