

Bio Friendly Dentistry: A Review

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Abstract:

Dental health care enhance oral health and well-being of patients and to achieve such goals, dentists use a diversity of materials and instruments that has a definite impact on the planet's eco-system. Green dentistry is a type of dental practice which is environment friendly, cost-efficient, saves time by reducing waste, decreasing pollution and conserving energy with the use of latest techniques and procedures. The aim of this article is to increase awareness and practice of eco-friendly dentistry, conserve resources, curb environmental pollution and eco-friendly and cost-effective waste management.

Keywords: Global warming, Bio friendly dentistry, Green Dentistry, Sustainable Development, Innovative dentistry, Dental Waste, Waste Management, Recycling, Conservation.

Introduction:

Global warming due to environmental pollution is one of the serious problems facing humanity and other life forms on our planet today. Pollution shows health hazards in human beings, animals and aquatic life. Directly or indirectly every human being is responsible for this and dentistry is not an exception.^{1,2}

Oral health plays an important role in maintaining general health and well-being of individual. Practicing dentistry has a major impact on environment. According to the Eco-Dentistry Association (EDA)'s, "Dental practice generate 4.8 million lead foils, 28 million liters of toxic X-ray fixer, 3.7 tons of mercury waste, 1.7 billion sterilization pouches and over 680 million chair barriers, light handle covers, patient drapes and 57,000 gallons of water with high amount of electricity is used each year. With these facts, it is established that dentistry has a great effect on the environment and changing these principles and practices toward a greener environment is the need of the hour"^{3,4}

Eco-friendly dentistry is an environment friendly practice, it is a practice that reserves time as well as money by means of waste reduction, pollution deduction and energy conservation with use of latest techniques thereby protecting the environment. Sustainable dentistry integrates dentist's commitment to society and environment. It refers to practicing dentistry using technologies, procedures and materials that do not cause any harm to the environment.^{6,7,8}

The aim of writing this review is to make dental professionals understand the need of practicing bio friendly dentistry and measure's which can be taken to achieve that aim.

Definition:

Eco-friendly dentistry term is coined by Dr. Gorankralj and Dr. Stevenkoos. They defined it as a new innovative practice of dentistry, which encompasses a simultaneous devotion to sustainability, precaution, prevention and a minimally invasive patient-centric as well as global-centric treatment .

Eco-friendly dentistry features incorporating green design and operations in dental practice, This protects immediate health of patient and dental team members, surrounding community and preserve natural resources.^{5,9}

History:

The term “Green dentistry” dates back to the 5th European Dental Students' Association Congress of Belgrade, Serbia, in 2003.

The eco-friendly dentistry was first published international by Dr. Ali Farahani and Mittale Suchak on April 3, 2007.

On December 22, 2009, Dr. Steven Koos trademarked and officially defined eco-friendly dentistry.¹⁰

Steps To Green Dentistry:

The “Four Rs Of Going Green,” Namely Reducing, Reusing, Recycling, And Rethinking.

1) REDUCE

In-order to decrease the pressure on the earth’s resources, people must reduce their consumption by reducing the waste of useful products, raw materials, water pollution and air pollution, respectively.^{11,12,13}

- **Minimize amalgam discharge:**

Use amalgam capsules, If mixed amalgam remains after a restoration this can be recycled do not dispose scrap amalgam into the garbage.

Amalgam shavings and bits of amalgam from the drilling or restoration should be intercepted by drain traps or screens. Installation of chairside filtration devices, which trap larger particles of dental amalgam and protect vacuum pumps and also Installing an amalgam separator.

Amalgam substitutes: To use new dental materials that do not contain mercury, or could consider alternative treatment options.^{14,15,16}

- **Managing Photographic and X-ray Waste:**

Using digital X-ray instead of conventional system

Silver containing wastes: The Fixer that dental offices use to develop x-rays is a toxic material that should not be simply rinsed down the drain. Because of the high silver content used, fixer is readily recyclable.

Lead Containing Wastes: The lead foil inside each x-ray packet is a leachable toxin and can contaminate the soil and groundwater in landfill sites. Lead foil packets should never be thrown in the regular garbage. This material must be either recycled or treated as.

Use of lead-free patient x-ray aprons and shielding.

RVG usage eliminates usage of over-radiation, x-ray films, lead foils, developer- fixer solutions disposal hence being more environmental friendly with appropriate diagnosis.^{20,21,25}

- **Digital/paperless dentistry:**

Implement Paper less documentation and registration, electronic claims, electronic patient recall, feedback forms and reminders with digital technology.

Instructing dental suppliers to reduce packaging and combining orders to reduce shipping waste.
Implement of digital marketing and digital patient education.^{28,30}

- **Eliminating toxic Chemicals:**

Use steam sterilization instead of chemicals.

Using nontoxic, biodegradable, eco-friendly and approved surface disinfectants.

Use of toxic chemicals for cold sterilization should be reduced, such as those containing a powerful lung, and skin irritant.

Use of herbal disinfectants with high potency should be promoted and research in the field should be encouraged.

Use of Ultraviolet germicidal, in-operatory air purifiers to remove particulates from air.^{33,34,35}

- **Herbal remedies:**

Used in dentistry to improve the psychological or emotional condition of patients without the side effects of conventional drugs. Herbal medicine are useful for oral health in form of herbal toothpaste, mouthwash, hand sanitizers and gels. Live, green plants in the operatory increases oxygenation.³⁶

- **Dental Water lines:**

Should be cleaned regularly, using biodegradable or enzymatic cleaners. The water which is used in the practice should be filtered as it reduces calcium and other deposits increasing the longevity of the instruments and reduce maintenance cost.

- **High-tech innovations in dentistry:**

Computer-aided design/ manufacturing systems, it eliminates the need of impression material which means less wastage.

Laser diagnostic tools to be used for early detection of caries.³⁷

- **Energy and water conservation:**

1. Use of energy star-rated printers, computers, and other equipment
2. Installing LED and high-efficiency fluorescent lights
3. Installing motion sensors to turn off lights when people leave nonmedical areas automatically.
4. Assigning dental personnel who will ensure that everything is powered off at night
5. Adapting waterless vacuum system
6. Motivating and educating patients to turn off the tap during handwashing
7. Installing an in-office water distiller
8. Sterilization equipment should only be run when fully loaded and regular maintenance should be done.
9. Install solar or tinted shades
10. Install programmable thermostats
11. Install LED high-efficiency lighting^{39,40}

- **Home Oral Hygiene Practice:**

1 billion toothbrushes are thrown away every year, 50 million pounds of toothbrushes are added to landfills in the US annually. Toothbrushes are made from propylene plastic and nylon, which are non-renewable

fossil fuels. The bristles are made from nylon, and manufacturing it creates nitrous oxide, a greenhouse gas 310 times more potent than carbon dioxide. The handle is made of polypropylene plastic, and when discarded isn't recycled and it doesn't biodegrade.⁴¹

Eco-friendly alternatives for toothbrushes may be: i) wooden toothbrush, silicone based toothbrushes; plastic handle toothbrushes with changeable bristles. Alternatives for nylon dental floss may be: i) silk and candelilla wax floss, contained in glass and aluminum dispensers with floss-refills on sale; ii) silk and beeswax floss, in a cardboard or bio-plastic box, that are completely biodegradable.⁴²

2) Re-use

Reusable materials should be encouraged in dental practice which will save resources and energy to manufacture new product.

- **Disposable Product:**

Dental clinic disposable items can be replaced by the following:

Patient Cloth bib, Cloth headrest cover, Hospital grade cloth operator

, Reusable metal suction tips , Reusable cups and saliva ejectors, and sterilization method.

Use reusable stainless steel or compostable impression trays⁴²

- **Proper Storage Techniques for Oral Hygiene Supplies:**

This Increases life of dental materials and Prolongs the Use of Materials and Items

- **Prevent Rusting of Instruments:**

Use of alloys: stainless steel, is one of the common ways to prevent rust, or slow it down.

Store metal equipment's and products in a low-moisture area, or inside humidity-controlled environment to significantly slow down rust.

Storing dental materials properly as instructed by manufacturers, refrigeration of items like Impression materials, Resins cements to prolong shelf life. Use sealed lid containers for dental materials ,Keep the lid closed tightly when not in use or transfer bulk material to smaller container. Be sure to keep your instruments sharp: Using a dull tool slows the procedure and can produce less than satisfactory results. Use instrument cassettes, pouches and tub to maintain sharpness of the Instruments.

Lubrication and maintenance of rotary instruments and other equipment's is mandatory.^{18,19}

3) Recycle

Materials which are used in dentistry such as paper cups, magazines, general waste, old and damaged hand instruments can be recycled, giving them new life.

- Recycled inkjet cartridge and toner use should be promoted.

• **DENTAL IMPRESSION MATERIALS:**

Dental alginate is commonly used impression material, after usage they are disposed of in the garbage, this alginate impression waste can be recycled by the process of washing, drying and meshing. Recycled alginate add nutrients to soil fertility and crops. The increased calcium content can be used to improve soil quality and other nutrients extracted from dental alginate waste Nitrogen, Natrium, Phosphate, Kalium, Calsium, Mangan and Sulfur can support crop yields.

• **DENTAL X-RAYS:**

Films which are unused contain unreacted silver which are toxic to the environment. In recycling process, the films are washed in a chemical solution that separates out the silver. The silver is melted and turned into bars. After the silver has been removed, a piece of plastic is left which can be recycled. The silver can be reused in different fields.³²

• **GYP SUM AND PLASTER:**

Large amount of gypsum waste is generated in dental practice. Discarded gypsum waste onto the landfills causes hydrogen sulfide production which is toxic to the respiratory tract and nervous system. The disintegration of such waste can be done by treatment with 20% ammonium bicarbonate solution which exhibits antibacterial and antifungal property in a ecofriendly way . This solution disintegrates the waste into ammonium sulphate and calcium bicarbonate in the form of sludge which can be utilized as nitrogen fertilizer, fire-extinguishing powder, and in industries like pharmaceutical, textile and wood pulp. Calcium carbonate can be used in metallurgy industry, mainly in steel manufacturing.³⁹

• **DENTAL WAXES:**

Dental wax used for pre-clinical lab procedures should be collected and reused.(table 1)

• **METAL ALLOYS:**

Metal alloys can be effectively reused for fabricating new appliances, recycle old used metal brackets and broken hand instruments.¹⁰

Table 1 Dental waste disposal checklist

Waste	Type	Option
Amalgam particles	Traps, screens, excess mix	Send to a recycler or, Dispose of as a hazardous waste
Waste mercury	Spills, spill cleanup	Manage as hazardous waste by sending to a recycler
Empty amalgam capsules		Dispose of in the garbage
Fixer	X-ray processing	Contract to have silver reclaimed Install silver recovery system Dispose of as a hazardous waste
Combined fixer and developer	X-ray processing	Purchase kit from x-ray manufacturer to separate, and use methods listed for fixer and developer

Chromium containing ray	X-ray system cleaning	Switch to non-chrome cleaners Dispose of as a hazardous waste
Disinfectants	Used	Discharge to sewer
Chemoclave chemicals	Used	Discharge to sewer
	New	Call your local sewer treatment plant
Lead foils and shield	X-ray processing protective shields	Send to metal reclaimer
		Dispose of as a hazardous waste
Blood	Liquid	Discharge to the sewer
	Dripping swabs, etc.	Dispose of as infectious waste
	Non-dripping swabs, etc	Dispose of in garbage
Sharp		Infectious waste treatment facility or registered sharps collection station
Office waste		Recycle as much as possible

4) Rethink

Rethinking about practice and all the operative strategies in the dental practice in the light of sustainability and environmentalism. Environmentalism and sustainability are both considered states of mind. Implementing changes like things you can add or change, decrease water and energy consumption are the initial strategies to consider.³⁵

- **Government measures:**

Implementation of Corporate Social Responsibility (CSR) program within the cooperate structure.

Certified carbon offsets and investment into reforestation campaigns Create a “green team “to implement, monitor green dentistry Hu-Friedy implemented program called “Envirodent”which provide Free instrument in return for old ones.

Development of adequate information for proper treatment of dental waste is needed. Dental schools should dedicate adequate curriculum, time, and emphasis on environmental awareness of dental students during their training, Identification of existing recycling programs is necessary.^{28,42}

Conclusion:

It is a moral and ethical obligation for all Dental practitioners to practice an environment-friendly dental practice toward by focusing more on prevention, precaution, sustainability, and creating awareness. Dental community, especially students, stakeholders including Governments, scientists, manufacturers, distributors, dental equipment technicians, waste collectors and processors Should have consciousness about the environmental impact of dental products . On the other side, manufacturers, universities, those who spread the knowledge and those who educate, should concentrate efforts on the development and production of sustainable and eco-friendly Alternatives.

Dental schools should dedicate adequate curriculum, time, and emphasis on environmental awareness of dental students during their training. Development of adequate information and research for proper disposal and treatment of dental waste should be carried out.

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