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Taking a Step Towards Greener Future: Practical Guideline for Eco-Friendly Dentistry

Yeşil Bir Geleceğe Doğru Adım: Çevre Dostu Diş Hekimliği için Pratik Rehber

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ABSTRACT

Humans have had a tremendous impact on the ecology and of late have rapidly damaged its delicate balance. Dentists as protectors of oral health should not limit their responsibilities to patient treatment but also inculcate methods to protect the environment as well. Thus the concept of eco-friendly dentistry or green dentistry has been introduced. Eco-dentistry or "green dentistry" is a practice of dentistry using technologies and materials that promote and protect the planet. It is a thought process, an attitude, and a guide for making earth friendly choices in dental practice. This article intends to provide guidance to practitioners about the practical changes we can make in practice, so as to minimizing the release of potential pollutants and reduce the impact of dentistry on Earth.

Key words: Bio-waste, green dentistry, practice management.

ÖZET

Ekolojinin hassas dengesinin bozulmasına ve hızla tahribatına insanlar neden olur. Diş hekimlerinin ağız sağlığı ve hasta tedavisinin dışında çevreyi korumaya yönelik metodlar da denemelidir. Böylece çevre dostu diş hekimliği veya yeşil diş hekimliği kavramı getirildi. Gezegeni korumak ve buna katkıda bulunmak için "eko-diş hekimliği yada yeşil diş hekimliği" materyalleri ve teknolojileri diş hekimliği uygulamalarında kullanılır. Bu düşünce süreci ve yaklaşımı, diş uygulamaları için bir rehberdir. Bu makale,yeryüzünde dişçiliğin etkisini azaltmak ve potansiyel kirleticileri minimize etmek için pratik değişiklikler hakkında çalışanlara rehberlik etmeyi hedefler.

Anahtar kelimeler: Biyolojik atık, yeşil diş hekimliği, tıbbi çalışma yöntemi.

Introduction

Ever since humans have set foot on mother earth, knowingly or unknowingly we have had a tremendous impact on the ecology. We have evolved from simply being a part of the food chain to use of petroleum based products, chloro-fluoro carbons etc., all of which has rapidly damaged its delicate balance. Thus, the need for a green movement is a warranted and necessary step focused on saving our planet[1]. With the increase in the environmentally conscious people in medical sciences, dental practitioners too have begun to play their part, although they do not fully understand the potential adverse effects of dentistry on the environment.

"Eco‐friendly dentistry" attempts to reduce the detrimental impact of our profession on the environment and promote environmental awareness to patients. Eco-friendly dentistry mainly: Reduces Waste and Pollution, Saves water, energy and money, is high-tech and supports a wellness lifestyle[1,2].

Dental practitioners are becoming increasingly concerned about the impact of dentistry on the environment and are ready to take voluntary measures to reduce the same. However, practitioners, though much interested, do not have a comprehensive knowledge regarding the changes required in practice management to be a successful environmentally friendly office. Thus this article aims to provide a simple and effective guideline for practice of eco-friendly dentistry.

How is dentistry polluting the environment?

Dentistry by the following causes detrimental impact on environment[3]:

- Use of X-Rays
- Silver Amalgam: improper use and disposal
- Chemical Sterilization by use of toxic products
- Usage of disposable products during patient care
- Office activities (lights, paper, equipment)
- Biomedical wastes
- Contaminated post dental treatment water

The 4 R's of Going Green

Being eco-friendly is not about just recycling office paper and plastics, it is to bring about drastic changes in consumption patterns. This can be achieved by applying 4 basic rules to your daily activities[4].

- **Rethink -** The first step towards change is awareness. To rethink is to simply be aware of the consequences of all our daily choices and its impact on Earth.
- **Reduce -** The earth is rich with resources and the best way to protect them is to simply save what is left. The equation is simple: use less, gain more.
- **Reuse -** Re use is the terminology used when a product is utilized again for the same function, or where it is used alternatively for a different purpose
- **Recycle -** Recycling is the terminology used to describe the breaking down of a used product into raw materials which are used to make new products.

Ways to Go Green

There are many ways to make your practice environmentally friendly. It can be started from simple avoidance of use of plastic based products. However, to make a full-fledged impact towards a positive effect, one must consider all the changes for a better practice management, starting from your office, to the change in products used in treatment and finally to management of used instruments.

Start with Your Clinic: Building Green

Buildings and the process of constructing them are responsible for a major amount of energy use and environmental degradation. A green building is defined as "one whose construction and lifetime of operation assure the healthiest possible environment while representing the most efficient and least disruptive use of land, water, energy and resources"[5]. The changes which can be easily incorporated include:

A. Design changes for your office

- Locate your office in such a manner so as to ensure that better exposure to sunlight. First floor or above provides best opportunity for exposure to natural light. It not only cuts down your electricity bills, it also helps in natural sterilization by UV rays.

- Wall to floor windows which ensure maximum utilization of natural light. Even skylights can be installed for better usage of natural light.
- The position of your X-ray equipment is crucial. Place the equipment as well as your dark room in the peripheries of your dental office where in proper ventilation is present. This prevents the stagnation of the fumes into the dental operatory.

B. Efficient use of lighting

- Use energy-efficient lighting. This can be done by incorporating Light Emitting Diode (LED) and Compact Fluorescent Lights (CFL) bulbs[6-9].
- LED is the current most revolutionary concept in lighting. LED light bulbs use only 2-17 watts of electricity (1/3rd to 1/30th of Incandescent or CFL). LED bulbs last up to 10 times as long as compact fluorescents or typical incandescents. They do not have a filament, and thus are not damaged easily like a regular incandescent bulb. Since they do not cause heat build-up; thereby helping to reduce air conditioning costs in the office[10].
- Install a dimmer lighting system to save energy. This helps by only using as much light as needed depending on the office's natural light[10]. Lighting can also be controlled by occupancy sensors to allow operation based on presence of motion (people or animals) in the room.
- Consider using alternatives to conventional power consumption such as : wind mill generated electricity, solar electric panels and water heaters
- Install energy-efficient office equipment (computer screens, washer etc)[11].

C. Paint green

Most of the paints available in the market contains volatile organic compounds (VOCs) which may be emitted in trace portions, along with biocides and plasticizers for a year or so post application of the paint. This unhealthy indoor air on extended exposure can lead to eye irritation, respiratory problems, headache, loss of coordination, nausea and damage to the liver, kidneys and central nervous system in rare cases. However, many companies nowadays offer alternative low- and no-VOC formulas[12-14].

D. Decorate with responsibility

- Use office furniture made by recycled or reclaimed wood. Many companies and carpenters have now begun harvesting wood from old furniture and reusing it, which reduces the cut down of trees.
- Use of recycled stainless steel products instead of wood furniture is also a good option as steel products have a long life span. This reduces waste production and prevents unnecessary land fill[15].
- Avoid Furniture made from manufactured wood products: particleboard, fibreboard, plywood etc., as all of these can contain formaldehyde glues[15].
- Bamboo is best second option to wood. It gives a similar appearance to wood and also is grown with few to no pesticides.
- Add a green plant to an operatory and immediately increase the oxygen available in the room and improve the quality of air indoors[16].

E. Green flooring

- Marmoleum floors are made from materials abundant in nature (Linseed oil, Wood flour, Rosin, jute and very finely ground limestone) and are also produced in an environmentally-friendly manner. Marmoleum is fully biodegradable after 25 to 40 years' use and in this way can be given back to nature[13,14].
- Stratica by Amtico Intl. is a high-performance, eco-polymeric resilient flooring. PVC-free and low-VOC Stratica flooring is another eco-friendly option for flooring.

F. Every drop of water counts

- Dentists usually recommend teeth to be brushed twice a day for two minutes each time. The Eco-Dentistry Association has determined that every time the faucet is left running while brushing, up to 90 glasses of water is wasted. A simple act of closing the tap can provide 90 extra glasses of water to be used for another time[6].
- Use sensor-operated faucets or Use low flow faucets and fixtures.
- Install water-free urinals or low-flush or dual-flush toilets.

Treatment with an Eco-Friendly Touch

Dentists as protectors of oral health should not limit their responsibilities to patient treatment but also inculcate methods to protect the environment as well. This can be easily incorporated in our daily practice in the following manner:

A. Patient charting

- Utilize a virtual office for patient charting and billing. Recently a wide variety of softwares have flooded the market which help patient data management such as Eagle Soft, Dentimax, Purple Ice etc.,[17].

B. Go paperless

- Every ton of recycled paper saves about 17 trees. Recycling paper uses 60% less energy than manufacturing virgin timber paper. Paper recycling has amazing effect on the environment. It can be as simple as Reuse of shipping boxes or using shredded paper for packaging material. Even old envelopes can be used for scratch paper.
- One can also edit letters and other paperwork on screen rather than by paper, receive and store articles and journals online and check and pay financial statements electronically[16,17].
- Patient recall can also be managed by electronic devices such as e-mails and messaging.
- But in many situations, paper cannot be avoided completely. In such instances, use of chlorine-free, recycled paper instead of traditional paper products are advocated. Print double-sided and buy recycled file folders for storage[17].

C. Learn your electronic products

- Switch off the electronic devices when not in use, electronics that sleep on a standby setting continue to pull a current. Be aware that AC adapters on some power cables pull current despite being switched off; so pull the plug from socket when not in use.
- Consider solar chargers for charging equipments like cell phones, PDA, laptops etc.
- Electronic devices too need to be modified for maximal energy output. For example, Use LCD computer/ T.V screens instead of Cathode ray tube (CRT) screens[5].

D. **Reusable products for patient care** [figure 1]

- Use stainless steel cups instead of disposable paper or plastic cups. If using a disposable cup is a must, use biodegradable disposable paper cups[16].
- As dentists, infection control is of utmost importance. In most instances, we prefer plastic barriers for dental chair covers and patient drapes. Approximately 1.7 billion sterilization pouches and 680 million chair barriers, light handle covers, and patient bibs are thrown away each year in the US. Instead, cloth based products can be used which can be sterilized and reused[1].
- Use reusable stainless steel surgical/endodontic suction tips[5,19].
- Use glass syringes as a substitute for disposable plastic syringes as endodontic irrigation devices.

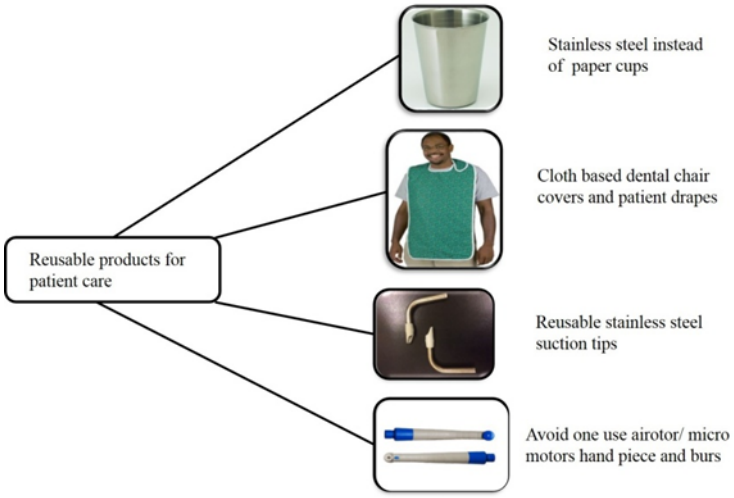

Fig 1. Reusable products for patient care

- Use disposable plastic or paper barriers in cases of absolute necessity; prefer cloth based products.

- Avoid one time use burs.
- Use of cloth based handle cover for light and tray cover[19].
- Prefer to buy products with minimal use of materials (aluminium, paper, plastics etc.,) in their packaging. It is pertinent to avoid use of PVC plastic containers, as they are unfriendly in recycling and may release acid gases if incenirated[20].

E. Environmentally-friendly sterilization program [figure 2]

- Sterilization and disinfection of instruments is of most value for protection of our patient and ourselves. However, it is not necessary that the patient protection is done at the cost of the environment. The most environmentally safe sterilization technique is use of autoclave. Even dry heat ovens can be utilized for the same[19].
- Reusable cassette and instrument pouches: replacing your disposable sterilization pouches with reusable ones is an easy, economical and quick way to go green[4].
- Ultra sonic cleansers are now a common sight in dental operatory. However, most cleansers use a harsh chemical surfactant. Be conscious while choosing a cleanser. The market has a variety of low surfactant based enzymatic cleansers which are equally efficacious and less toxic.
- Avoid Chemical based sterilizing solutions. Halogenated sterilants have been known to have a detrimental effect on the environment. The sterilants should not be poured into the septic system as the bacteria which normally breakdown wastes may be distrupted[14].
- Cleaning floors are usually performed by various hazardous chemicals. Many detergents contain phosphates, which damages the delicate eco system. Wastewater treatment only removes a small amount of the phosphorous, leading to stream and river contamination. Use products low in phosphates or are phosphate-free. Use Green seal certified cleaning products, which offer the most eco-friendly cleaning solutions. Many companies such as 3M®, offer these products in India[14].
- Use dry vacuum systems instead of wet ones. Liquid ring vane pumps use water to create the suction and are therefore called 'wet' pumps. This results in use of large amounts of water and electricity. Use instead a dry suction system, which is designed in such a way

that excess amount of water is not needed saving large amounts of water and electricity[21].

Fig 2. Sterilization protocol

F. Recycle one and all [figure 3]

- Base metal casting alloys: The metallic dental restorations or appliances are usually prepared by casting technique, in which 50 – 60 % of the alloy remains as wastage. The remaining wasted materials can be effectively reused for fabricating new restorations or appliances by proper cleaning techniques. There is only 5 - 10% decrease in their mechanical properties even after 20th recast. The only concern is the biocompatibility aspect, which can be still checked after each recast[22].
- Dental waxes (modelling wax / base plate wax): During the fabrication of acrylic dentures, they are first fabricated using wax, which are invested in dental flasks using dental stone, and then eliminated by flushing with boiling water to create a suitable exact mould for acrylization. In this procedure the wax is not consumed but used and rejected. About 80 – 90 % of this wax can be recollected and purified by simple

laboratory technique. As this is an laboratory procedure, there is no question of biocompatibility[22].

- Silver amalgam restorations: 1/4th of silver amalgam is wasted in dental clinics. Mercury is the heavy metal of concern in amalgam, as may be discharged into the waste water by dental professionals. Mercury is recovered by heating the waste amalgam at >4500 C in a safety hood, evaporated mercury condenses and comes out of the mix, which can be purified and reused[3,22,23].
- Use of an amalgam separator: The placement and removal of dental amalgam restorations generate solid and particulate wastes. Amalgam separators capture up to 99% of the scrap amalgam and waste amalgam from the waste water before it is discharged to the sewer. This prevents introduction of mercury in restorative material from entering ground-water systems[3,11,22].
- You can also recycle old and used metal brackets by sending them back to the company purchased.
- Recycle the broken or non-usable instruments by registering to Hu-Friedy's environment program® or such programs.

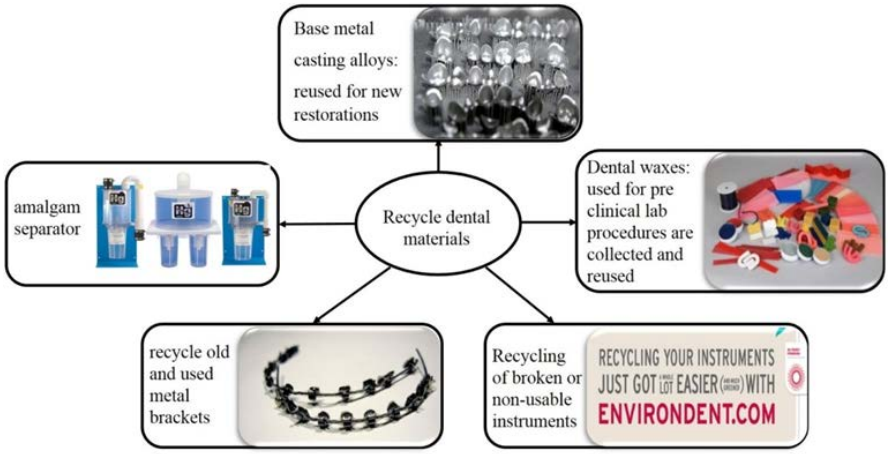

Fig 3. Recycle dental materials

G. Management of radiation and its associated products: [figure 4]

- Lead: lead is a hazardous toxic metal that contaminates soil and waste water if disposed in regular garbage. It is particularly toxic in children younger than 6 years old and can result in learning disabilities, seizures or death. Thus, Lead must be disposed of properly. The most common products containing lead in dental operatory are lead aprons/shields and lead foil present in traditional radiographic film packets. Lead aprons can be disposed of either by selling it to a local scrap metal recycler, contacting the original manufacturer or a radiation accessories dealer. This is advantageous as you may be given a new apron at a reduced cost[23].Lead foil may be disposed of by recycling the foil through a vendor who provides this service, like Eastman Kodak® or by selling it to a local scrap metal recycler[7,23,24].

- X ray films: Used and unused film should also not be disposed in the general waste. Unused films contain toxic unreacted silver. Polyester film, typically used may be returned to companies for film-base recovery and silver recovery. Both polyester and cellulose triacetate films can be returned[24].

- Fixer solutions: Used fixer solution contains silver. Dental offices use a very small amount of fixer relative to photographic processing facilities. Fixer solutions contain silver thiosulphate complexes which on undergoing waste-water treatment processes is converted mostly to silver sulfide, which settles in the sludge. Use an in-office silver recovery unit (metallic replacement or electroplating system) to remove silver from used fixer solutions and recycle the used cartridge. An example of the metallic replacement system is the Kodak Chemical Recovery Cartridge (Eastman Kodak®, Rochester, N.Y.). The silver recovery process may yield a return when the collected silver is sold to a refiner. For most average- sized dental offices, the silver recovered in a recovery cartridge will not be enough to cover refining costs or to return any credit. However, the use of a silver recovery cartridge can provide an easy and economical way to comply with municipal discharge regulations. Silver also can be recovered from small batches of fixer by pouring the solutions into a silver recovery cartridge. Send used fixer solution to a silver-reclaiming facility, medical radiology laboratory or a commercial photographic processing laboratory if an agreement is made with these facilities. The desilverized fixer can be diluted with water and mixed with developer and disposed down the drain[24,25].

- Developer solutions: Waste developer may be flushed down the drain as long as the pH is close to neutral or sent it can be sent for recycle; but it should not be mixed with fixer[3].
- Harvest the benefit of technology: Using digital imaging (not traditional X-rays) which has a dual advantage. It not only reduces the chemicals required for processing of films, but also reduces patient radiation exposure by 75 to 90%[3,10,25].

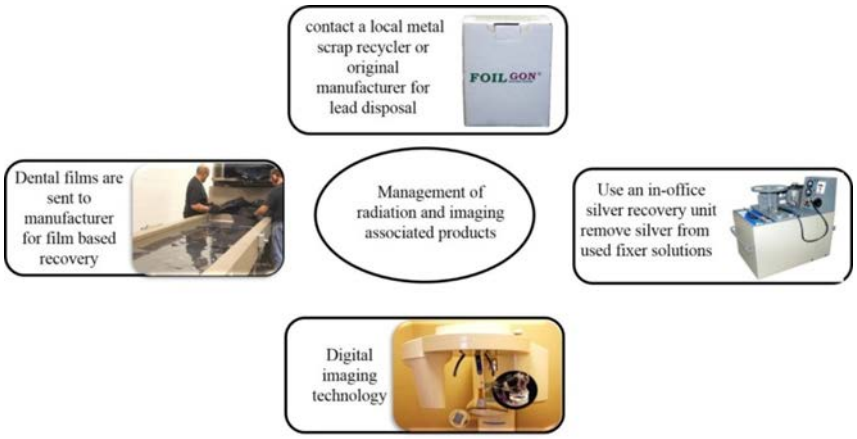

Fig 4. Radiation management

H. Dispose with care

- Gloves are the most common by product of patient care in a dental office. Use natural/ rubber latex based gloves are easily degradable.
- Blood-soaked/dripping gauze and sharps are a biomedical hazardous waste. It should be enclosed in a puncture proof biomedical waste bag and once accumulated, a certified biomedical waste carrier (CWC) should be contacted for recycling or disposal[24,25].

İ. Enlighten your patients

- Take a few minutes at the end of your treatment to speak about how your patient can help in the green movement. Eg: How we reach our work place? Sharing a ride to work with a friend or two effectively doubles your fuel economy[11].

- Provide a few thought provoking concepts to make their home or office more environmentally conscious.

Conclusion

Every day man is discovering the progressing impact of his presence on the environment. Thus it is only pertinent of us to try and contribute to the wellbeing of the society. It is a myth that being environmentally friendly may be too much work. Eco-friendly dentistry is, simply put, implementation of sustainable practices by keeping resource consumption in line with nature's economy, safeguarding the external environment through the elimination or reduction of outgoing wastes and promotion the well-being of all.

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