



## Role of eco-friendly dental clinic option in water saving

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### ABSTRACT

Water shortage is considered as a major problem worldwide. Moreover, the adverse effects of climate change would make the issue worse. Most classical dental facilities had inappropriate water consumption practices. Green dentistry is an innovative approach to a dental procedure that is environmentally sustainable while also saving money and time by minimizing waste, conserving water and energy, and lowering pollution through the use of cutting-edge techniques and procedures. However, scarcity of studies about this topic represented the main challenge to our study which was overcome by carrying out precise data collection. Our main objective was to clarify the role of eco-friendly dental technology in water saving. Environmental case study approach was used to answer research question and formulate a hypothesis. Data was collected from several evidence based sources. The study results showed that there was a significant reduction in water consumption after the implementation of Eco dental options. The current findings shed light on the significant role of green dentistry on water saving and serves as a base of future research.

### Introduction

One of the most important economic and social problems of the century on a worldwide basis will be the concern with water resources (Bhutiani *et al.*, 2021a&b; Ruhela *et al.*, 2022). Egypt is one of the nations that will experience significant issues due to its fixed portion of the Nile and its restricted access to groundwater, rainfall, and desalinated water (Abdel-Shafy and Kamel, 2016). Seventy percent of this need is met directly by the Nile River, and the bulk of the other 30% is met by the Nile indirectly through its groundwater aquifers, reuse of agricultural drainage water, and return flows from the river (Amer *et al.*, 2017). Water shortages could occur as a result of increased competition for water in the upper Nile basin (caused by the Grand Ethiopian Renaissance Dam) (Abdel-Shafy and Kamel, 2016). Additionally, the negative effects of climate change, including the potential impacts on the Nile Delta and coastal areas of sea level rise and temperature rise that increases water evaporation, would make the issue worse (Amer *et al.*, 2017). Egypt experienced a 21 Billion Cubic Meters (BCM) per year water shortage in 2019 (Elkholy, 2021). The Egyptian

government has taken steps to address this issue, such as treating industrial effluent and sewage, which can provide about three billion cubic meters of water annually (Abdin and Gaafar, 2009). Water desalination is already one of the options that have been implemented to use seawater as a source of water (Fried and Serio, 2012). Furthermore, in the agricultural sector, the chosen strategies were to minimize either the crop consumption rate or the water loss rate through irrigation canal lining and maintenance, and subsequently to reduce water demands and shortages (Abdel-Shafy and Kamel, 2016; Bhutiani and Ahamad, 2019). Because wastewater treatment and desalination plants are costly, consume massive energy, and utilize a lot of chemicals, every effort should be taken to conserve water resources by lowering water usage as well as wastewater output. Therefore our current perspective focused on the water aspect of dental treatment.

#### Standard approaches

There are thousands of dental clinics in Egypt including the private and public sectors; one of the most important sectors continuously consumes

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significant amounts of water through cleaning, sterilization, and suction procedures. In addition, dental clinics use many types of equipment for which electricity is required such as compressors, drills, overhead lights, operatory lights, and computers. The majority of dental facilities use standard technology approaches which consume and waste a huge amount of water and energy.

#### Modern approaches

Green dentistry is the practice of using technologies, methods, and materials that are not harmful to the environment (Fotedar, 2014). It can be done by conservation of water and energy, use of nonhazardous products, reduction of waste, and eliminating hazardous chemicals that negatively affect patients and the environment such as the chemicals used in the processing of X-rays which can be replaced by digital X-rays and promoting increased usage of green products.

Worldwide, Eco-dental clinics implement modern technology in their equipment such as dry dental vacuum pumps, fast cycle automated cleaning equipment washers/thermal disinfectors, and Eco sterilizers. Additionally, installing low-flow faucets and water-efficient toilets will be helpful. This technology significantly reduces overall water consumption, moreover, it has a positive impact on the environment by reducing the amount of wastewater. Additionally, this option will significantly minimize energy consumption which in turn minimizes the negative contribution to climate change. However, few studies have been performed on the assessment of the impact of Eco dental clinics on water saving.

#### Eco-friendly dental technology solutions:

##### Suction system in a dental clinic:

The usage of a dental vacuum is crucial at the dentist's office because it facilitates the removal of saliva, debris, and bacteria from the patient's oral cavity while dentists work (Dentalez, 2021). Dental vacuums come in both dry and moist varieties. Dry vacuums use no water, in contrast to the 350–500 gallons per day that conventional wet ring vacuum systems in the US use. We're thrilled to employ waterless pumps since they help us save over 200,000 gallons of water annually. Water conservation is a major issue at the water cooler these days. In the United States, only around 10% of dental offices have converted to dry pump

technology, which uses 77% less water than the typical dental office. Beyond financial considerations, everyone in our community has a moral obligation to conserve water (Studio Z Dental, 2022). Since most dry vacuum systems are belt-driven and so use less electricity over a year, there are other ways to reduce costs and resource utilization. Although the initial expenditure is greater, it soon pays for itself frequently in 3–4 years (Dentalez, 2021).

#### ECO sterilizers (Steelco, 2022)

Some sterilizers are already more efficient than comparable types. To help clients conserve water, even more, ECO water and energy-saving packages have been introduced, which can lower overall water consumption by up to 90% depending on the options chosen, with a 13% reduction in energy. Steelco ECO 1 and ECO 2 options are two of these sorts as part of its environmental water-saving philosophy.

#### ECO 1

This standard option contributes to a 35 % reduction in water consumption by requiring less water to cool the drain before discharge.

#### ECO 2

This method uses cold water from a chilled water system. It is made up of a series of high-efficiency heat exchangers that allow for significant savings in vacuum pump water consumption and a reduction of over 90% in overall water usage. Drain water is also chilled, thus no extra tap water is required to lessen the temperature before discharge, as illustrated in Figure (1).

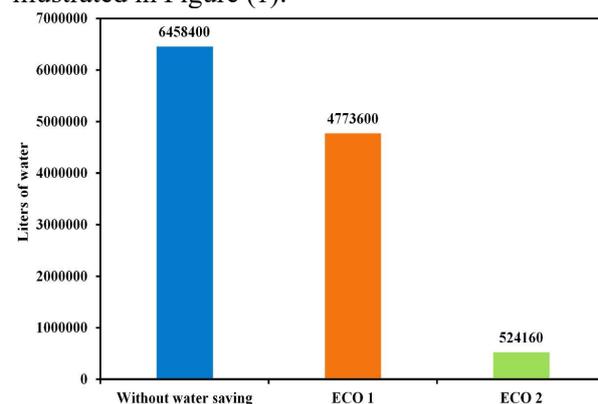


Figure 1: Annual water usage in liters of a Central Sterilization Supply Department (CSSD) in a typical university hospital with 4 units of 18 Standard Measuring Unit (STU) sterilizers with house steam: 15 cycles per day, 6 days per week, and 52 weeks per year.

**Water conservation consolidated's-water eco series sterilizers (Consolidated Sterilizer Systems, 2022):**To comply with local building codes and reduce the temperature of the effluent discharged to the drain, most modern autoclaves use a substantial volume of water. This water quenching may consume up to 1,600 gallons of water each day! The Consolidated Water Eco Series dramatically reduces water use, saving up to 99 percent of the water used by other market autoclaves.

**Consolidated's water eco series:**

**Water eco :**All Consolidated sterilizers include this mechanism. They not only save water but also monitors usage and cool effluent with a combination of air, previously cooled effluent, and a little amount of cold water.

**Water eco-plus :**This technology saves water by using a stainless steel heat exchanger that uses the facility's chilled water supply, effectively eliminating the need for once-through cooling water.

**Water eco vacuum plus:**This system integrates with pre-vacuum autoclaves when chilled water is readily available. The full recovery system uses chilled water to cool the vacuum water and exhaust and is the best solution to minimize water.

**The benefits of water eco sterilizers:**A single ecologically friendly autoclave can save a facility approximately 60.000 gallons of water per year. Based on current utility prices, over fifteen years, that translates to \$100,000, assuming SSR-3A, 3 cycles each day, 30 minutes at 250 degrees Fahrenheit with 5 minutes dry (Consolidated Sterilizer Systems, 2022).

**A fast cycle washer disinfecter:**It is worth saving about 54.000 liters of water in a year of normal use! It also conserves both time and energy (Steelco, 2022). Overall, we compared the different aspects of eco-friendly dental technology to provide an overview so we can decide which is more useful or valuable as shown in Table 1. As it is apparent from this table, I can suggest that implementation of dry dental vacuum suction, fast cycle washer disinfecter, and Consolidated's Water Eco Series technologies or ECO sterilizers – ECO 2 together will be the best choices to reduce water consumption in dental facilities.

**Table 1: Comparison between different eco-friendly dental technologies regarding water saving**

SN	Eco-friendly dental technology	Water saving by (%) or water liters or gallons
1	Dry dental vacuum	77% - 200,000 gallons of water annually
2	ECO sterilizers – ECO 1	35 % reduction in water consumption
3	ECO sterilizers – ECO 2	90% in overall water usage
4	Consolidated's Water Eco Series - Water Eco Series Sterilizers	99% - 584,000 gallons of water annually
5	Fast cycle washer disinfecter	54.000 liters of water in a year
6	Water Eco sterilizers	60.000 gallons of water per year

**Outcome**

Our findings suggested that there is significant reduction in water consumption, electricity, cost, and water waste after the implementation of Eco dental options (generated hypothesis). Accordingly, if Egyptian health care authorities implement these technologies in dental facilities licensing policy, we can easily test our hypothesis as there are thousands of dental clinics in Egypt including the private and public sectors.

**Relevance to sustainable development goals (SDGs) under climate change challenges:**

"Eco-friendly" and "green" are frequently used interchangeably and denote a variety of characteristics, including renewability, sustainability, energy efficiency, lack of toxicity, little invasiveness, and a lower carbon footprint. It encompasses sustainable and eco-friendly techniques, hospital and office design, and waste management in the healthcare sector. Sustainable dentistry combines dentists' responsibilities to society, the economy, and the environment (World Dental Federation [FDI], 2007). Eco dentistry implements sustainable practices by keeping resource consumption in line with nature's economy, safeguarding the environment through means that will assist in eliminating or reducing outgoing wastes, and reducing energy consumption, which in turn promotes the well-being of all individuals in the environment by a significant reduction of greenhouse gases generated in the breathable air, which also affect climate change (Adams, 2007). All of these impacts are compatible with the National Sustainable Development

Strategy (Egypt Vision 2030) goals, more particularly the fifth track, the theme of "Environment and Natural Resources Protection", section 2, "Stimulating and supporting the green economy" (Ministry of Higher Education and Scientific Research [MOHESR], 2019).

### Conclusion

Our study findings support the perspective that implementation of eco-friendly dental technology options could save considerable amount of water consumption. In my opinion, further intervention studies in the future are required to assess the effect of dry vacuum suction system, fast cycle washer disinfectant, and water eco sterilizer or ECO

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