

REALITY NOW

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Ozone Use in Dentistry

According to the Environmental Protection Agency (EPA) in the U.S., ozone is a highly reactive gas composed of three oxygen atoms (O₃). As the EPA goes on to tell us, ozone can be good or bad. The so-called “ozone layer” in the stratosphere is important because it reduces harmful UV radiation from reaching us on the Earth’s surface. But this good layer of ozone is presumably being depleted by man-made chemicals.

The bad ozone, on the other hand, is created at ground level mainly by pollution from emissions of industrial facilities, vehicle exhausts, etc. Our health can be adversely affected by this bad ozone, which can trigger respiratory problems by reducing pulmonary function. It can also damage vegetation that can affect agricultural production and the landscape of recreational areas such as parks and forests.

So if the ozone closest to us can be a threat to our health and environment, why are we even discussing its use in dentistry? The answer is in its property of being, perhaps, the most powerful oxidant and antimicrobial agent. This is true whether it is used by itself as a gas or added under pressure in water. In fact, it reportedly has much higher disinfection capabilities compared to chlorine and doesn’t produce harmful decomposition products. This is why ozonators, for example, are being used to reduce the amount of chlorine in swimming pools and spas. It is also being used by the bottled water industry to disinfect water before we drink it and has now been approved by the FDA to treat food. In addition, the FDA has recently approved an ozone sterilizer that can also inactivate prions.

What’s more, there is even evidence that deadly methicillin-resistant Staph aureus (MRSA) infections can be prevented and maybe even treated with ozonated water. Another use of ozonated water being proposed is for sinus irrigation, which could offer tremendous relief to millions who suffer from difficult to treat sinus infections.

With this short background, you can see why ozone has been adapted for use in dentistry. The most prolific researcher in this field is one of our own Editorial Team Members, Dr. Edward Lynch in Belfast, Northern Ireland. Dr. Lynch has been investigating how best to use ozone in dentistry for over 10 years and has helped bring the first, commercially viable ozone device on the market in most areas of the world, except notably the U.S., where it still awaits approval by the FDA. See **FirstLook** in this issue for a preview.

Nevertheless, the current products are pricey (including the device evaluated in this issue) and cost-effectiveness always has to be factored into any discussion about new technology. These types of discussions are important to ensure that emerging technologies have real value in patient care.

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REALITY Research Lab (RRL) Gloria A. Acosta, C.D.; Norma L. Cuitiva, C.D.; Maricela Aguilar, C.D.



TherOzone T-1000

TherOzone

www.therozone.com



(4.3)

RAVES & RANTS

- + Very easy to use
- + Many potential uses for ozonated water
- Very expensive
- Hard to see fill line through opaque bottle

PRICE:

\$7,495.00

WARRANTY

1 year

DESCRIPTION

Device that produces ozonated water for purging and disinfecting water lines in your dental unit as well as using it as a hard surface disinfectant and to soak instruments prior to autoclaving. There is also evidence and/or possibilities that its antimicrobial effect can be used to irrigate and disinfect cavity preps, root canals and periodontal pockets, especially the latter two when using ultrasonics. One research group used it to ozonate sodium hypochlorite, which dissolved tissue remnants faster and allowed a lower concentration to be used, thus reducing possible toxicity. In addition, it can be a pretreatment rinse for patients to reduce their oral bacteria count.

The unit looks like a large, white coffee maker, with a domed top and a recess in front for the bottle that acts as the reservoir for the water. At the top of this recess is the gray plastic female connector for the water bottle. Extending down from this connection is a flexible rubber tube that ends in a rigid sintered ceramic diffuser section perforated with 5 micron-sized holes through which the ozone gas is pumped into the water.

The soft touch control panel is located on the bottom half of the right side of the front section. The top of this control panel has a green LED power indicator that glows when the unit is on. Immediately below is the Start button/LED. Below that comes the Ready light and finally the Reset button/LED.

The bottle in which the ozonated water is produced looks almost identical to those which are used to hold the onboard water for your dental unit. However, just like your onboard water bottles, the opacity of the plastic makes it difficult to see

the water level inside unless you hold it up to a bright light such as a dental unit light. On the other hand, this plastic has proven to be durable and resists degradation by ozone.

The threads on the bottle should fit most dental units with the glaring exception of A-dec. If you do have an A-dec unit, you'll need to pour the ozonated water into an A-dec water bottle before you can purge your unit.

The large rear section of the unit holds the ozone generating compressor. A blue plastic accent strip covers the seam between the two sections and adds a little pizzazz to the otherwise utilitarian design.

The back of the unit at the top has the vent holes for the two internal cooling fans, while the bottom section has the simple toggle power button, the connection for the AC plug, and the time clock, which registers the actual ozone generating time. Since the compressor is rated at 5,000 hours or 30,000 cycles, it seems obvious that this piece of equipment should be quite durable.

Half of the evaluators considered the design of the unit to be acceptable, while the other half really liked the design.

DIMENSIONS

Height	18.3in/46.4cm
Width	8.0in/20.3cm
Depth	10.8in/27.4cm (including power cord)

WEIGHT

12.1lbs/5.5kg

USE

When you turn the unit on, the power LED will glow green, while the reset LED will be red. Fill up the water bottle with distilled water to the maximum fill line. While not essential, a funnel makes filling this bottle easier and keeps drips to a minimum. Even though the written directions give you the option of using water between 5-20°C or 40-68°F, the manufacturer's website instructs you to use refrigerated water. Presumably ozone is better dissolved in cold rather than room temperature water. In addition, tap water can be used instead of distilled water, but the ozone dose will be lower.

After filling the bottle to the maximum fill line, screw on the gray plastic male connector, thread the rubber tube through the hole in the connector, and push it up into the female connector attached to the unit. These two connectors just snap together easily and quickly. At this point, the bottle filled with distilled water is just hanging in the unit without any support underneath. Once the bottle is connected, the red reset light goes off. Note that the unit will not start generating ozone if the bottle is not connected properly. This is a safety mechanism built into it.

Then you push the start button and the ozone generation begins. The start LED turns amber and the sound from the compressor is unmistakable but not distracting or annoying. During the time the ozone is being generated, there are occasional and brief puff-like sounds, almost like water hitting a hot pan on the stove.

According to the written directions, it will take about 10 minutes for the ozone to be generated, while the website states 5.25 minutes, which is exactly the time we recorded. When it is finished, the ready LED glows blue, but the two internal cooling fans stay on for an additional two minutes. All the evaluators felt the machine was easy to use and the generation time was acceptable.

To remove the bottle, retract the sleeve around the female connector while holding the bottle with your other hand. The bottle disengages very easily and, after removing the rubber tubing, the ozonated water is ready to use. The unit itself generates ozone as a closed system, which means there is no ozone gas released while it's being generated assuming the bottle is connected properly. The unit also converts any unused ozone back into oxygen, which is another safety feature.

However, some individuals may notice the ozone odor, which is coming out of the water similar to the fizz when you first open a bottle of soda, as soon as the bottle is removed from the machine. None of the evaluators were bothered by this odor, although several staff members in one office found it offensive. For this reason, you would probably not want to keep the unit in a treatment room.

According to the manufacturer, the ozonated water has a half life of about 30 minutes. This means you should use it as quickly as possible. If you are going to use the ozonated water to wipe down your treatment room, moistening unbleached gauze or towels would be best, since the chlorine residue in bleached towels could affect its potency.

Note: The manufacturer sells a third party kit for \$65.00 to test whether the ozonated water really was generated. While the kit itself reminds you of a high school chemistry set, it is reasonably easy to use and did confirm that the water that was generated contained ozone.

EFFECT ON BOND STRENGTH

Since ozonated water has been proposed as a cavity disinfectant, we tested its effect on bond strength using total-etch (OptiBond Solo Plus) and self-etch (Bond Force) adhesives. The results showed that there is no effect on bond strength.

MAINTENANCE

There is no routine maintenance required. After 40-45 hours of use, the plastic inside the female coupler (the one attached to the unit) presumably degrades to the point of needing to be replaced.

DIRECTIONS

Our unit came with a plastic-laminated, foldout that is easy to follow and has numerous illustrations. But as noted previously, some important information such as the need to refrigerate the distilled water is not emphasized. The best and more updated directions are on the manufacturer's website.

REALITY

STRENGTHS Unit is well-made, requires minimal maintenance, and is easy to use and not overly noisy. Closed ozone generating system is safe – any unused ozone is converted back into oxygen. Can't run the unit if the bottle is not placed properly, which is another safety mechanism. Only requires slightly more than five minutes to produce the ozonated water. Antimicrobial effectiveness of ozonated water is impressive, including the ability to kill MRSA bugs, and no organism seems to be able to develop a resistance to it. Uses for ozonated water are numerous.

WEAKNESSES Very expensive. Most evaluators listed the price as the main disadvantage. Bottle should be more translucent. Bottle doesn't fit A-dec units. Odor is offensive to some people.

BOTTOM LINE The antimicrobial effectiveness of ozonated water along with the multitude of uses and the ease and safety of generating it make this device very enticing, although the price in a struggling economy could be a major stumbling block for many practices.

FirstLook



HealOzone

KaVo

www.kavo.com

PRICE:

£11,934.48 in the UK (not available for sale in the U.S.)

Device that produces ozone gas for a myriad of intraoral uses. Consists of an ozone generator as a base unit and a handpiece fitted with a disposable sealing silicone cup. It was developed to apply ozone through the handpiece to the surface of the tooth affected by caries, although it has also been used in endodontics, orthodontics, and on soft tissues.

Due to the antimicrobial actions of ozone, it is used to arrest carious lesions and, in some instances, enhance their remineralization in combination with fluoride varnishes. In clinical tests, it has been shown that primary root carious lesions can be reversed and pulpal exposures can be avoided by leaving 1 mm of carious dentin over the pulp prior to ozone treatment and restoration.

In endodontics, microorganisms are dramatically reduced in root canals.

But perhaps the most instantly dramatic use is to treat sensitive teeth. According to users, a quick blast of ozone on a sensitive cervical area can render the tooth totally pain-free. These types of startling results make the use of ozone in dentistry to be very intriguing.

The base unit that generates the ozone from ambient air has a contemporary look, with the top dominated by the soft touch control panel and LCD screen. Measuring 14.6in/37.0cm high, 10.2in/26.0cm wide, and 10.6in/27.0cm deep, this is not a small piece of equipment and requires a generous allotment of countertop space. It also weighs 17.6lbs/8.0kg, so you are not going to be carrying it from room to room, which means it makes sense to place it on a cart with casters for transport and to free up countertop space.

The stainless steel handpiece nests in a bracket on the right side of the base unit. The handpiece is connected to the base unit via a 5.0ft/1.5m conventional flexible hose that is straight for easy cleaning. The handpiece is ergonomically designed and should fit most operators' hands.

The disposable silicone cups come in five sizes ranging from 3mm to 8mm in diameter. They snap on to the handpiece and after achieving a vacuum on/over the tooth, ozone can flow over the site. The actual treatment time is 10-60 seconds, which can be set on the control panel in 10-second intervals. If the seal over the tooth is compromised, ozone application stops immediately.

After the ozone gas is applied to the tooth through the suction-cup apparatus, it is then sucked out of the cup and channelled through an ozone neutralizing filter that converts the ozone back into oxygen. A liquid pH balancer is then applied. The pH balancer fluid neutralizes the residual bacterial acid and applies minerals, xylitol and fluoride in high concentration. The Patient

Kit contains fluoride, calcium, zinc, phosphate and xylitol and is claimed to promote remineralization within approximately six weeks.

The handpiece disconnects quickly from the hose for post-treatment autoclaving. Additional handpieces can be purchased separately. From a practice management standpoint, it has been reported that the fees range from £20 to £50 for each use.

Already spawning clones, HealOzone appears to be a revolutionary approach to preserving tooth structure. While clinicians in many parts of the world are already climbing on the bandwagon, practitioners in the U.S. must wait until the FDA gives its blessing. Since we have not been able to evaluate HealOzone or any of its clones due to the absence of this FDA clearance, we can only state that the research findings combined with the anecdotal reports are very promising. Let's hope FDA approval happens sooner rather than later.

New on the Website | LED HEADLIGHTS



LED technology, which has almost completely taken over the curing light market, is doing the same thing with headlights. The latest models can match most of the fiber optic halogen units for illumination power, although they usually fall short of metal halide versions. LEDs also produce a very white light reported to be 5500 degrees Kelvin. However, the beam of light emitted from an LED headlight is typically more diffuse than the more spotlight-type beams produced by the fiber optic units. Nevertheless, the freedom from being tethered via an umbilical to a control box, which is the typical setup with a fiber optic unit, is a powerful incentive to purchase an LED.



While this new section in **The Ratings** only features two products at this time, both of these units are excellent, one of which has earned the coveted 5-Star rating, with the other one being just slightly behind. If you have purchased a 2009 Annual Edition, these products will be among the many news ones featured. But if you want a sneak preview, you can check them out right now at www.realityesthetics.com.

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