New technologies for dental care: Part 2

In this second article on ozone technologies, Dr Julian Holmes explores how the HealOzone Unit is used and what lessons are to be learnt about this new technology

In my first article, I reviewed the current methods dental practitioners use to detect decay and briefly mentioned the DIAGNOdent from KaVo. The 'niche environment' theory of caries formation was introduced, as was how ozone may have a part in the management and treatment of decay.

In this article, I will show you how new technologies can have the most profound effect, and not only on our patients' desire for treatment.

To date, in many dental practices worldwide, caries detection, and therefore the elimination of decay, depends on visual recognition with the aid of a mirror, probe and X-ray analysis. Studies have shown that these traditional systems can be inaccurate, with computerised analysis of digital radiographs, dyes and tests offering a little more accuracy.

Fissure sealants

Fissure sealants may leak and cause decay. Some practitioners are old enough to remember the first fissure sealant preventative systems. We used these fissure sealants on teeth that were most at risk to decay, namely the first permanent molars, and by the time we got to treat these teeth, the fissure patterns were already stained.

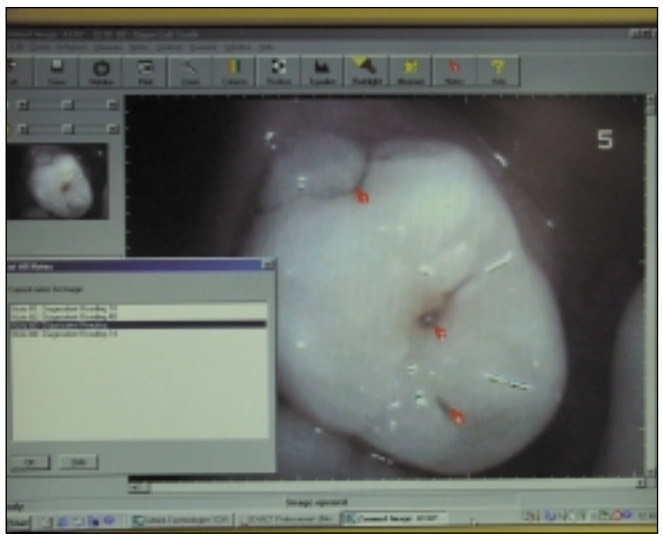

Figure 1: A custom screen has been designed in the computer management system to record DIAGNOdent data

We used pumice to clean the tooth surface with a bristle brush, acid-etched the enamel surface, floated on the mixed varnish and waited for it to set. As an undergraduate, I was taught that once the sealant had been applied, no food substrate could reach any bacteria trapped deep in the fissures, so the carious process would be avoided.

I now realise that, of course, the bristles could not clean out the fissure pattern totally, so most of the contaminated debris may be left in situ and we are aware that some bacteria are unaffected by acid etchants. I suspect that, like me, many of my contemporaries have seen cases years later where the decay process has slowly continued, leaving a hollow shell of enamel. This is explained by micro-leakage around the margins, allowing the ingress of food substrates to the trapped bacterial colonies.

Stains versus early carious lesions

So how can we improve our diagnosis of a stain versus an early carious lesion, as this is one of the hardest diagnoses to make? Part of the research into ozone technologies was to look at a reliable and reproducible way to measure decay.

The DIAGNOodent has been available for over three years now and works by shining a laser at the tooth surface. Once calibrated to the patient, the level of decay is expressed as a number on the screen and as an audible tone. The higher the number and tone pitch, the larger the area of decay. What the machine actually measures is the fluorescence of bacteria and, indirectly, the density of tooth structure and the presence of decay.

Reliable data

In my practice, we use the PROPHYflex System from KaVo to clean the surface thoroughly, ensuring the DIAGNOdent measurement is not caused by impacted debris or stains. The working tip of the PROPHYflex pushes out a slurry mix of sodium bicarbonate and water, and it is very effective at stain and debris removal. The DIAGNOdent is then used to measure the occlusal areas that are suspect.

We have designed a custom screen in our computer management system to record this data. On molar teeth, we use the intraoral camera system first to photograph the tooth and then add notes of the readings over the surfaces (Figure 1).

We note, but do not treat, values up to 10. In the past, we would have treated any surfaces with readings of 10 to 15 using air abrasion and fissure sealants. We now recommend the use of the HealOzone to reverse the demineralisation that has been found. Moreover, with values over 20 where we would have removed tissue with either air abrasion or a drill, we now offer the use of the HealOzone as an alternative.

Amputating tooth tissue

As a profession, we are taught to amputate the diseased tissue from a tooth, and we have a wide range of systems to help us do so. We have the traditional turbine, diamond coated and carbide burs, ultra-sonic tips, air abrasion, and chemicals, such as Carisolv, to remove tooth tissue. All are very effective but they all amputate tooth tissue.

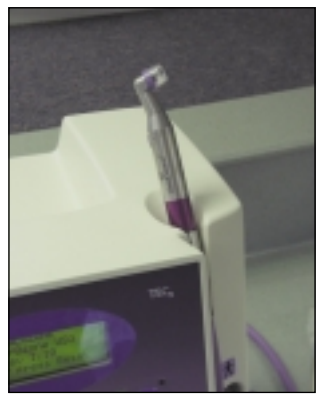

Figure 2: The HealOzone unit

In the first article, I outlined the ozone research results produced by Professor Edward Lynch and his team at Queen's University, Belfast, which shows that a 10-second exposure to ozone gas deactivated 99% of bacteria, viruses and fungi. When caries are exposed to ozone gas, the majority of lesions remineralise. As the acidic carious niche environment can take years to establish, it is unlikely that the niche will redevelop before remineralisation takes place. But how does this help us in practice, away from the research laboratories?

The HealOzone unit (Figure 2) is made by CurOzone and distributed by KaVo Dental Limited. It delivers a 10-second burst of ozone gas at a pre-set concentration, through a hose and handpiece, into a polymer cup that is placed around the tooth surface to be treated (Figure 3). To fulfil health and safety regulations, a seal must be achieved around the tooth surface, which protects against the contra-indications of high ozone exposure. Without this seal, the HealOzone unit will not produce ozone gas. At the end of the 10-second ozone exposure, the unit vacuums any residual ozone back through a catalyst that converts this ozone back to oxygen. This takes just 10 seconds. To complete the treatment, the HealOzone unit then pumps a reductant fluid/mineral wash onto the treatment site, to kick-start the remineralisation process. This only takes a further five seconds.

So, in just 25 seconds we can eliminate the micro flora that cause decay and start the 'healing' process of a carious lesion. Once ozone treatment has been completed as necessary, the patient is sent away with an 'at-home care kit'. This consists of a

Latest results of ozone technology

In the first study, we selected 82 surfaces with occlusal decay. Each was measured with the DIAGNOdent following our protocol.

The most common tooth that needed treatment was the upper right 7 molar

The most common start DIAGNOdent value was 85 and the most common finish value after treatment was 24. We saw most patients at a recall period of 64 days after the first treatment and the most common change was 20 units.

The average first value was 70 and the average second value was 15, giving an average 'healing' index of 55. On average, we saw patients 79 days after the first application of ozone.

KaVo and Curozone are seeking pathfinder practices to invest in this technology. For a reduced cost, pathfinder practitioners will be asked to collect and send in their treatment data, part of a European study. This will be limited to approximately 40 practices in the UK, the remainder of the HealOzone units going to other European countries. If you want buy into the new technology at a reduced cost, please call KaVo on 01494 721521 (UK) or CurOzone Germany on +49 611 3605110 to become a pathfinder practice

Figure 3: HealOzone delivers ozone gas through a hose and handpiece into a polymer cup that is placed around the tooth surface to be treated

dentifrice and convenient full-size and travel bottles of mouth rinse, with patient information detailing the instructions they must follow for the treatment to be successful.

Critical follow-up

The follow-up is critical to the success of this technology. The research team recalled patients at three- and six-month intervals to re-measure the treated lesions. We have just started our three-month recalls.

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Having cleaned the treated surfaces using the PROPHYflex, we then compare our initial data records and photographs, using the DIAGNOdent to record new values in the original data locations.

To date, our results mirror those achieved by the research team in Belfast. Our patients are as astounded as we have been at the success of this painless technology.

I am sure that, like myself, many of my colleagues who have attended the presentations are questioning when to use this technology and when to use a traditional filling. In my case, I have found that we no longer have to place any filling materials in the majority of lesions. I mentioned earlier that we have been pre-conditioned to restore a cavity when we detect one. It has to be remembered that traditional means of caries elimination demands the amputation of diseased lesions. In most cases, it is impossible to define the exact limits of this, so we tend to remove far more tissue than is actually required. In so doing, we severely weaken the entire tooth structure, which could lead to catastrophic tooth failure and its eventual removal.

The HealOzone eliminates 99% of the micro flora and so the decay process halts. Once remineralisation begins, the naturally restored tissue is far more resistant to decay. This has been shown in previous studies. We already know that it can take years for the niche environment to develop, so provided the patient's oral hygiene remains at an improved level, and the remineralisation process continues, there is no need to place any restoration at the first visit.

One important factor that needs to be remembered is that during the initial stages, the treated areas of decay will be relatively soft and will not support any restoration. Therefore, if a restoration is planned after ozone treatment, it should be planned at the review appointment by which time, the research data suggests, the remineralisation process will be well advanced, the lesion static and the tissue hard enough to support a restoration. In addition, waiting three months or more may decrease the amount of tooth tissue that may have to be removed to obtain a cosmetic result. This, in turn, preserves as much of the original tooth as possible.

> **In just 25 seconds, the HealOzone can eliminate the micro flora that cause decay and start the 'healing' process of a carious lesion**

The next article will look at how we promote this technology in our practice, how we cost it and the reaction of our patients. ■

Please note that the data from current research studies may not support the possible future uses of ozone in the dental management and treatment of patients. The views, wishes, and conjecture in this article are the opinion of Dr Julian Holmes.