Healthy Mouth World Summit

Guest: Dr Julian Holmes

The Use of Ozone in Dentistry

Will: The next expert to share their knowledge and experience with us here at the Healthy Mouth World Summit is Dr. Julian Holmes. Dr. Holmes is a practicing dentist and one of the world's leading researchers on the use of ozone in dentistry. Dr. Holmes is the president of the International Association of the Use of Ozone in Medicine and Dentistry. He co-authored with author Edward Lynch the textbook *Ozone: The Revolution in Dentistry*. He has literally published hundreds of articles of the benefits and safety of using ozone in dentistry.

Dr. Holmes lectures around the world on the emerging subject of ozone in dentistry. And he's been actively teaching dentists worldwide on the protocols he and his associates have established and developed around the clinical use of ozone in dentistry. Dr. Holmes will be speaking to us today, of course, on the subject of the use of ozone in dentistry.

Dr. Julian Holmes, welcome to the Healthy Mouth World Summit!

Dr. Holmes: Well, it's a real pleasure to be able to chat to you again. I have very fond memories of when we last met, even down to the incisor marks, which are still in embedded in my finger from last seeing and last treating your daughter. So, no surprises in some respects!

Will: [Laughs] Thank you, thank you. It's wonderful to be talking with you, as well, again, sir. So, the title of your talk is "The Use of Ozone in Dentistry." Can you please start by setting a baseline of understanding explaining what ozone is to our listeners?

Dr. Holmes: Yes, certainly. Ozone is a gas. It's a naturally-occurring gas. And to put it into a world context, we have something called the ozone layer. It sits just above our breathable atmosphere. And it's a very thin layer. It's only somewhere around about two to three millimeters to a centimeter thick. So, it's incredibly thin. And it's very easily damaged. So, the whole concept of the holes in the ozone layer are really important.

Ozone stops cosmic radiation and some of the energy particles from the sun. And it absorbs that energy and breaks down into oxygen, which then reforms back into ozone. But, as usual, man has a slightly different idea of the atmosphere. And we use it to, really, dispose of most of our smokeable and waste gasses.

And, so, there are a number of really important pollutants like CFC gasses, which destroy the ozone chemically very rapidly and irreparably. So, where we have really thin areas of the ozone layer, people are exposed to more solar radiation. There's higher instances of skin cancers.

If you took away the ozone layer itself, we would probably die of solar radiation within a short period of time. And life as we currently know it and enjoy it on earth would cease to exist. So, ozone is incredibly important in a global scale.

In a much smaller scale, ozone is actually produced by the white blood cells in every living person's tissues and circulating blood. And this concept was first talked about by some guys from the Scripps Institute in the States, which is a research institute in the U.S.A. And, for many, many years, it was held as almost like a shining beacon by various regulatory authorities that ozone was a dangerous gas and had no use whatsoever.

Well, fortunately, the science has proven them wrong. And, we now know that white blood cells produce ozone. It's part of the natural defense mechanisms for humans and for animals to combat viruses, bacteria, and fungi. So, you can consider ozone at two levels. You've got the protection from the solar radiation at a large macro scale. And in a much smaller microscale, ozone is produced within our bodies to counter potential threats and infections.

Now, we can actually harness ozone. We can make it. Those experiments were done in the 1800s. And, we can use the powerful bactericidal and virucidal and fungicidal properties to help actually combat infections in various parts of the body. And, indeed, it's used in industry on a worldwide scale to sterilize water supplies. That has been since the late nineteenth century and the early 1900s. The whole of the London underground system was actually sterilized with ozone by the Victorians.

And, at a much later stage when computer chips started to be invented, contamination with a single bacteria can cross four or five circuit lines. So, they use ozone to sterilize and remove potential pollutants, which could short circuit the circuit boards and PCBs.

Now, in agriculture example, we use ozone to help remove pollutants from ground water, potential ground water pollutants. And, so, ozone has wide application, both in industry and in healthcare, both to protect and to destroy, depending on what application is being looked at.

So, does that really set the scene for you, Will?

Will: It does. Absolutely. And, really, perhaps before we get into...Or, I guess we can do so in both ways. I was thinking before we get into the applications that you understand ozone in dentistry and how that can be a very useful tool within the field of dentistry, maybe you could explain how ozone works on bacteria, fungi, and what not, as far as an oxidative agent.

Dr. Holmes: Yeah. Of course. Basically, the cell walls of bacteria are made of sugars. And the same with fungi, as well. Ozone is an incredibly powerful oxidant. It wants to attack sugars and proteins. And you have to remember that a virus is basically a protein molecule. The same with a newer type of infective agent, which is called a prion.

These naturally-occurring infective organisms and products are very prone to oxidation given the right environment. Now, they have learned over many, many years -- mainly through abuse of antibiotics, which are a very recent and modern form to combat infection -- because the effect of antibiotics is fairly slow and fairly insidious, bacteria have a fantastic reproductive cycle, which can then build in a resistance to that bug.

So, we have the emergence of a whole interesting range of multi-resistant bacterium. MRSA would be a fantastic example of that. You can feed it whatever you like. It just looks at you, says, “Thank you very much for lunch,” and goes back to work. There is not a single antibiotic which can actually affect or kill MRSA at the moment. But, yet, if you expose it to ozone, it kills it straightaway. And the key behind this instantaneous elimination of these microorganisms is that ozone attacks their basic cell walls.

You have to remember even though they are just bacteria, they have a fantastic potential to create very, very complex communities, which feed each other and are self-supporting. But, if you attack them in the right way, you can eliminate them very quickly.

Now, because they don’t have time to build up a resistance to ozone because the effect is so quick, in the probably 200 years that ozone has been used in medicine and dentistry, there’s never been a single instance or report in the literature where a bacterium, a fungus, or a virus has actually developed an immunity or resistance to ozone itself, whereas the international journals are full of reports of resistance to what we would call standard antibiotics.

And we’ll just say part of this is the abuse, not only by practitioners, but also the abuse by patients, too. I mean, we still have patients who come into my surgery that have a common cold, which is virus-related, and they want antibiotics. And we’ve almost gotten to a stage where we, because of the medical-legal aspects of treating patients, we have to practice defensive medicine. So, you give them the antibiotics in the knowledge that it’s going to cause problems, potentially, later down the line.

So, it's a dual-edged sword, which, as clinicians, we face. We understand the fears and concerns of the general public. But at the same time, there is a necessity for a lot of education out there.

Will: Sure, sure. So, what is the molecular structure of ozone, and how does it differ from other oxidators? Like, why don't people just use bleach?

Dr. Holmes: [Laughs] Okay. We breathe O_2**.** So, from a strictly scientific point of view, we actually breathe dioxin. It's basically a dioxygen molecule. It's two oxygen molecules hooked together, which is a very stable compound. If you energize the oxygen -- O_2 -- it breaks into O_1. And it will rejoin in a number of different products. Some have existences which are measured in actually microseconds. Others are slightly long-lived.

So, if you started to investigate the type of oxygen molecules that were coming out of an ozone generator, for example, you would have somewhere around about fifty different varieties of oxygen in different excited states on different compounds on different products. The ones which we're really interested in are O_2, obviously, because that's what keeps us alive; O- because that's actually very reactive ;and O_3, which is 3 molecules of oxygen -- i.e. this is ozone -- and one of those O- wants to get away as fast as it can.

So, ozone has what we'd term a half life of somewhere around about five to ten minutes, depending on the pressure and the temperature and the surrounding environment. So, if you cup your hands and then you fill it with ozone and then you open your hands, within about two or three seconds, it's actually at the same

concentration as the room into which you just released it. And, most of that ozone would have virtually disappeared by the time 20 minutes has gone past. So, it's very reactive. It has this fantastic ability to create gradients of concentration very rapidly. And, I guess its downfall is you can't just bottle it and make it and give it to your patients or buy a bottle of ozone across the counter because after about 15 to 20 minutes, that bottle of ozone will be just oxygen all over again.

So, you have to actually make ozone at the point of application. And that's why we have a number of ozone generators which are used in industry and in medicine where you basically plug it into a main supply. You create a very, very large voltage so it almost looks like a blue arc. If you pass oxygen through this high-energy field, you excite the oxygen molecules. They break up into O-, and then the recombine, usually with a mixture balanced between Oxygen, O_2, and ozone, O_3, with a number of other products, which really don't matter at all.

So, that's how ozone is formed. And the reason why it is so active is because it wants to give away this oxygen molecule. It wants to react in comparison to, say, the reactivity of other common oxygens, and, we quite rightly mentioned, say, bleach. Bleach is, on a scale of 1 to 10, somewhere around about 2. Ozone is 10. There isn't actually another stronger, naturally-occurring oxidant as ozone. It's very, very reactive, it positively wants to get in there.

And the really interesting thing about ozone is that, say if you put it into an area of soft tissue, it doesn't destroy it. It actually starts to release oxygen, which then converts itself into hydrogen peroxide. The hydrogen peroxide then breaks down into water and more oxygen. So, you get this concept of super oxygenated

tissues, which become sterile. But, also, it switches on all the reparative mechanisms. The tissue starts to respond and heal incredibly rapidly.

Will: Right. So it functions very differently than other oxidizing agents like chlorine or other oxidizers out there?

Dr. Holmes: Well, let's put it this way. There was an interesting report last year about a dog that was left standing in a puddle of drain cleaner, which was basically a chlorine-based drain cleaner -- very strong oxidant. That type of chlorate solution destroyed this dog's pads, and almost his feet. And this dog nearly had to be put down. You would never find that if he had stood in a puddle of ozone.

Will: Right. So, let's get into how this applies within the field of dentistry. Can you explain to us generally how ozone offers beneficial applications, and how this is really a new paradigm within dentistry?

Dr. Holmes: Okay. There's two main threads to that discussion, Will. So, let's look at, say, areas of infection first, and general healing second. Areas of infection, if we look at, strictly speaking, say, decay. Decay is basically a microenvironment which is created by mineral loss on the tooth's surface. Once that tooth surface has lost so much mineral, it becomes weak and it cavitates. So you have the formation of cavity. That offers a protective environment called the niche environment in which, instead of just having 8 or 9 different bacterial species, anywhere up to 450 to 460 different bacterial species establish a mature complex community.

Each level within that community, i.e. each species of bacteria, provides an effluent or a metabolite, which is then used by the next species down. So, the byproducts that these bacteria produce become the food for the next species as you troll and as you gradually move through this maturing legion and this maturing colony. And it gets to a stage where, if a cavity becomes self-cleansing, then you'll probably have a little bit of residual softness to it. But, it can get to a stage where, if you remove most of the bacteria, it's possible to remineralize and heal that area.

Once a cavity is formed -- and this is an important point, because I get this question quite a lot -- a tooth can't regrow an area that it's lost through demineralization. So, a cavity is always going to be a cavity. But, you can set up the biology within that cavity as such that it becomes actually like stable and hard and glassy.

So, within a cavity, you expose it to ozone. Ozone will actually vaporize the microbiology. It vaporizes, not only the bacteria -- because remember they're just sugars or polysaccharide cell walls -- it vaporizes all the products that are actually inside the bacteria.

So, if you looked at some of the test systems -- which we have to actually look at what happens in the process of ozone treating a cavity -- you would see it goes from a most amazing array of different proteins and different acids and different byproducts that these bacteria both have inside the minerals so they reproduce with to being almost two spikes. One is carbon dioxide. And the other is something called acetate acid.

Now, we talk in terms of pH or the acidity of a patient's mouth. In the process of decay, the legion itself is very acidic. And under those conditions, minerals flow out of the tooth, which is why you have this process of demineralization, i.e. it softens, it cavities at a certain point in time when the surface can no longer be supported by the underlying structure, and the pH or the acidity is somewhere around about 2 or 2.5. It's a very, very intensely acidic environment. And the bacteria love it.

After you've exposed it to ozone, even though we call it acetate acid, it actually has a pH of around about 6.5 to 7. So now, it's swung the other way and it becomes neutral. Under neutral conditions or basic conditions as it's called within chemistry, minerals will reflow into the tooth. So, you can harden it. You can't rebuild the bit which has been lost. But you can harden it to such a point that the decay process can never, ever start in that hardened lesion again. So, that's one importance or one important area.

The other important area is sterilization. Now, say a patient comes in. They've got a large hole in the tooth. You scoop it all out. And under the old system, which was drill and fill, i.e. tissue amputation where you amputate the diseased part, you then clean it. And if you put a filling straight in, you've probably left the acidic byproducts and the infection still within that tooth structure. Then you put a filling over it. And the nerve tissue doesn't take kindly to having acidic byproducts sitting quite close to it.

So, over a process which can be many, many years, the nerve tissue can eventually die after three, four, five months or even years. And the dentist looks at it and really doesn't understand the process of why that tooth has died. And, of

course, the patient just feels it's bad luck. Whereas, in fact, if somebody had addressed the chemical processes right at the very start, that tooth could have been simply cleaned, treated with ozone, thoroughly sterilized, the filling is then put into a sterile cavity, and then that filling will actually last for maybe the lifetime of the tooth.

So, there are essential differences. If you like the old concepts of treating decay, which is basically drill and fill or tissue amputation to the new concepts of treating teeth, which is, first of all, microdentistry where we're using magnification. And we're trying to get those cavities long before they've actually cavitated, almost at the initiation stage, treating them with ozone, sterilizing them, and then putting them in place either some form of filling which will release minerals or/and improving the oral hygiene and giving them the tools they need so they understand the processes and they could actually take either mineral supplements or a mineral mouth rinse, which will carry on that remineralization process.

So, very often in practice, where we have to change people's attitudes, and certainly as a lecturer researcher, it's actually changing the professions attitudes toward built-in concepts. When I qualified, which was over 30 years ago now, we were taught drill and fill. And that's what every dentist knows. That's how they're told.

Their issue is not so much with that, but the expectation that the general public and the patient has. They come in to a dental practice. They have a hole. They're already all prepped and ready and expecting a filling. And trying to explain to this, if you like, pre-prepped and preconditioned population is really difficult.

As you well know, changing people's attitudes is the hardest task which a healthcare professional has. Let's take a simple example: smoking. We all know it has dire consequences in terms of longevity of life and health issues. And you can talk all you want as a healthcare provider to somebody who smokes tobacco or chews it. But do you think they're going to change overnight? No way.

Will: Right, right. Actually, you struck a chord there that I wasn't aware of, the idea of utilizing ozone after a dentist has cleaned out the cavity area. That makes a tremendous amount of sense. I fairly recently learned this idea that one of the reasons that fillings fail, which they obviously do, and a lot of the public doesn't even realize this they have a filling placed and they think, okay, it's there for the life of the filling or the life of the tooth.

Dr. Holmes: [Laughs] No...

Will: But, in actuality, there's a tremendously common time that you'll get decay underneath that filling. And I think it's a very interesting idea to utilize ozone in that way. It makes a heck of a lot of sense.

Dr. Holmes: Well, in very early stages of looking at the research behind ozone, I was working with professor Edward Lynch in Belfast University at the time, as part of his research group. And when we started to lecture to other dentists, we sort of coined this concept of the cost of ownership of a tooth.

Now cost of ownership of a tooth, simply put, is once you have a small cavity and it's being filled, irrespective of how good a clinician that dentist or doctor or

therapist feels they are, it will fail at some stage in the future. The filling gets larger and becomes more expensive. As it breaks down further, you lose little bits of tooth because under the drill and fill options, usually the drilling process leads to microfractures, say, under cusps. Once a cusp pops off, you can either put a bigger filling. And again, you have to remember that these fillings were not intended for wholesale tooth or functional tooth surface repair and replacement. They were made for small fillings. And that's exactly where that technology has stayed.

As the restorative care becomes more complex and the filling becomes larger and there's less of a tooth left each time, then you start to move down into crown work. And eventually when that fails, if the oral hygiene is not controlled, you're then into root canal treatment. And then you're in to extraction.

Once the tooth is lost, you're going to get bone loss in that area because the tooth is dependent on functional bone to support it. So, you get aesthetic and cosmetic changes in the patient's facial profile and also in the support for adjacent teeth where that tooth has just been extracted.

So, now you've got the possibilities of either conventional crown and bridgework, which is hugely expensive, not in terms of the cost of the process or the cost of the actual crown and bridge. But it's expensive in the terms of tissue which has got to be cut to prepare the adjacent teeth to the space to actually accept crowns for the bridge to be swung on.

The alternative is to put an implant in. Now, dental implants have been well-researched. They've been around for 45 or 50 years now. Out of all the

technologies which have come over into dentistry, I guess implants have probably changed people's appreciation of what dentists can do the most. But the cost of ownership of that tooth now has gone from a teeny, weeny filling to now a dental implant. And if that fails, then it's like, what do we do next? Do we put some form of denture in place or do you just lay down and say, "That's fine. Take the rest of my teeth out"?

So, this concept of cost of ownership, I think, is actually very important and needs to be perhaps talked about in a different forum to this because unless patients actually understand their responsibilities and the clinician understands where his responsibilities begin and end and the patient takes up their responsibilities in their home care, the cost of ownership and the patient's appreciation of what dentistry is about is always going to remain at a very low level in terms of appreciation of what dentistry is all about. Dentistry should be about prevention, but also fixing problems in such a way that the cost of ownership doesn't start to spiral out of control.

One thing which we've emphasized on the lectures which we gave to healthcare professionals was that once that patient enters into that cycle of destruction, they can never get off. That filling will fail sooner or later, irrespective of how well its put in. Even if you use ozone, potentially that filling will fail.

And, of course, the larger the filling gets, the more likely it is to fail catastrophically at some stage in the future, which is a really important point to take home because it's all about at-home care, which goes back to how your parents viewed dental care and how those children start to view dental care and what value they put on their teeth and their smile.

Will: Right. Excellent, excellent point. So, definitely it sounds like this application of ozone in dentistry is a paradigm shift. It's way less invasive than the old school drill and fill model.

Dr. Holmes: Absolutely!

Will: From your perspective, are you seeing ozone treatment, slowly at least, replacing this old school dental filling application?

Dr. Holmes: Very slowly. There are two main reasons. The first would have to be the cost of equipment. Whenever you take a piece of equipment into the general public, certainly in the U.K. and, I know, in the states, it has to go through a regulatory authority to make sure it is safe. That involves doing research on its hazards. Does it produce a poisonous gas? Will it harm the patient? And so on and so on.

In terms of the actual costs, say, for the kavo healozone, the CE marking and associated research to get it to a stage that we could get a medical device marked for European launch, was somewhere around about 30 million pounds. So, the figures become absolutely staggering.

And, you've either got to be a very well-heeled and independently wealthy financier to put this sort of deal together, to create basically a completely new technology, or you have to go to one of the major industries and say, "We have a fantastic product. We want you to run with it." And it was a bit of both. And that's

really how the healozone and Kavo and Curozone, who own some of the patents, really put that deal together and launched the healozone back in the 2000s.

Are we seeing a shift? There is a growing shift amongst the profession. It actually has its roots probably about 100 years ago. And we called it then “minimally invasive dentistry” where you’re using smaller and smaller drills to create teeny-weeny holes rather than big ones which you can then climb in with a hard hat and a JCB filler. Well, when you talk in terms like that, patients start to figure out and understand what’s happening.

But, in effect, this amputation and drill and fill, it’s all about hard hat and JCB digger. That’s how big these cavities get. As soon as you go down the minimally invasive, or how Edward and I started to talk about micro-invasive dentistry where you’re trying to pick up the disease process at a much, much earlier stage, that really is the key to the longevity of, not only the restorative part, but also for the patient to actually keep their teeth in pristine condition for the rest of their life.

But, to do that, you’ve got to take on the whole new range of technologies. Most people’s eyesight, by the time you get to my age -- I’m in my fifties now. And I’ve been around for thirty years looking at very small things -- it’s not so good. So, you’ve got to start to wear magnification. Lots of dentists I know hate glasses and they hate wearing magnification.

You’ve got to invest in diagnostic tools. If you look at some of the technology, which actually looks inside a tooth to discover where the decay is and if it’s there, does it have an index number which tells you how severe it is, you’re talking somewhere around about $4,000 or maybe $4,500 thousand dollars starting. So,

not only do you have a paradigm shift, but you've also got an investment shift, also, on the part of the individual clinician, which they have to make to actually start practice this way.

But, once you actually make that step, you can't go back. I mean, dentistry becomes so exciting in that you're actually helping people in the way in which you were taught to rather than just becoming just another drill and fill merchant and entering them into that cycle depressively of one filling after another.

But, yes, you're right. It is a very slow process. Changing attitudes, as I said before, not only of the public, but also the clinicians, is one thing. We also have a group of healthcare researchers who are in their own right well-known researchers within dentistry and in healthcare, as well, who there is a lot of professional jealousy.

And, certainly, it was something which I was unprepared for when I started my research and when I published one of the very early papers. There was a lot of negative publicity around it because either those people hadn't been invited or it countered their own little theories or it countered what they'd just said in another paper. There are all manner of reasons.

It's quite depressing at times to be in research because you know that you can look at these results and think, "Fantastic! I'm on to something," in the expectation that it is going to get pulled to shreds, trashed, denigrated, as fast as they possibly can because it doesn't fit into their model.

And that's the sad bit of working in some these professions. There's always those people who choose to tear really good research apart for whatever reason so that they can maintain status quo.

Will: Sure, sure. You're essentially on the fringe if a person is in the field of research.

Dr. Holmes: [Laughs] You're right at the cutting edge in the case of dentistry. And it's a pretty uncomfortable place to be at times. But, you do it because...Why do I research? Interesting question. Somebody asked me this a couple days ago. I think it's the excitement that you're involved in a shift in the profession which is not only a shift of profession, but also a shift for the patients and the general public, which in my experience, I have never, ever had a technology in my practice which has had so many benefits. And I haven't seen a single negative outcome when I've used ozone.

I've seen lots of negative outcomes when I've either been doing surgery -- patients come back in pain and swelling -- or you put an implant in and it falls out. Or you put stitches in and the stitches tear. Or you're using a rotary diamond drill, and the patient just happens to move suddenly and unexpectedly and they wind up with a 2-centimeter gash in the side of their mouth.

With ozone, you don't get any of that at all. And it is probably the only technology I've been involved in designing, but also used as a clinician, where there have been only positive results from a clinical standpoint.

Some of the other technologies which we have which have really changed people's appreciation would be the laser diagnostic system and probably the intraoral camera because for the first time, patients can actually see what's going on. And when you put a picture of a small hole on a 40-inch screen, it looks huge. I can tell you! And patients then start saying, "Oh, my God! I hadn't realized that was what was going on. What can you do? How can you fix it?"

[Inaudible] different aspect to holistic care. As soon as you start talking in terms of holistic care, I think that term has probably been hijacked in a negative way. So, we tend to talk in terms of micro-invasive dentistry because it actually is exactly what it says it is.

Will: Right, right. I love the idea of the intra-oral camera because it is inherently empowering the individual. It's empowering the patient to what is going on. Without knowing what's going on, then we're literally completely at the mercy of the professional.

Dr. Holmes: Absolutely. This whole concept of co-diagnosis, I think, is incredibly important in today's modern world of technology. And, from a patient's point of view, the more they understand, the better their response to treatment suggestions or treatment options will be.

Will: And therefore their ability to respond, which is responsibility. They're going to take ownership and be like, "Oh, I need to make these changes."

Dr. Holmes: Yeah. Yeah.

Will: That's great. So, I recently heard from another dentist that they like to use ozone to address cavitations or infections in a jawbone. What other applications beyond treating tooth decay -- and you also shared the idea of sterilization pre-setting and filling -- what other applications does ozone show promise for?

Dr. Holmes: Well, it's probably easier to turn the question slightly around, Will, and say, "Which area of dentistry doesn't ozone have a part in to play?" And, I can honestly tell you there isn't a single facet of dentistry where ozone doesn't have a part. In my practice of dentistry -- and I know of friends I have who use ozone -- it is completely integrated into their practice of dentistry.

So, for something very simple, let's take sensitivity. You can expose a tooth surface to 60 seconds to 3 or 4 minutes of ozone. And you can literally switch off the most sensitive area. So, you can have a patient who will almost climb the ceiling with an ice cube. And you can put ice -- almost dry ice -- onto a tooth surface after it's been ozone treated, and they won't feel a thing.

To, say, doing veneer or crown preps, they tend to be quite invasive, very destructive as I mentioned earlier. And you can use ozone to desensitize them before you put either your tempers in place while the porcelain and metal work is being made, or at the time of cementation so you don't get a sensitivity reaction.

In terms of the cavity, say it's gone beyond the stage of just a simple blast of ozone and putting on something like a mineral-releasing filling in there, once you've cut your cavity and you've cleaned it with hand instruments, you can then ozone treat it to sterilize it prior to actually putting the filling in place.

This is a little bit aside, but when I was teaching students at Belfast University with Ed Lynch, we sort of did some tests with the final year students. And we had them cutting cavities, of course, in a clinic setting, which is academic in nature. You put on basically a rubber raincoat, which is called rubber dam, so the tooth and the cavity is completely isolated from the mouth so it can't be crossinfected with saliva.

But, if you do that, you don't have an opportunity to get natural minerals from patient's saliva back into the cavity again. So, we used to look at these final year students. We've taught them all the way up to the end of their sixth and seventh years that it's got to be isolated. They can't get it wet with saliva. They can't do this, they can't do that. And now we come along and tell them, "Okay, you've got a lovely, clean cavity. You've just sterilized it with ozone. We'd like you to get the patient to lick it." And they look at you as if you've gone completely out of your head.

But, if you think about it logically, the patient's saliva has the greatest concentration of minerals, which can be used to remineralize those areas of treated dentin and tooth material. That's where the mineral component, when it comes out of a tooth, goes to. And that's where it's going to go back.

And then, of course, we look at them and say, "If you don't like that idea, just get your nurse to lick it instead," which, of course, caused complete uproar at that stage. And, you know, I once made the mistake of mentioning that in a couple of lectures on a more public forum. And these clinicians thought I'd gone completely crazy. [Laughs] But, the point is that the patient's saliva actually contains all the minerals that the patient needs to get that remineralization process going.

So, even though you've ozone-treated it, you've got it nice and sterile, if you get the patient to lick it, yes, it's going to reinfect. But the reinfection is going to be so superficial, that all you've got to do is once it's bathed in saliva, just quickly dry it and re-sterilize it with ozone. And then off you go with your filling.

Will: Sure. And yet, you've laid down a bunch of the remineralization minerals.

Dr. Holmes: Absolutely! Again, it's looking at it from a scientific point of view and thinking logically about what you're doing rather than the knee-jerk reaction, saying, "Ugh! I can't possibly do that because it's going to reinfect!" Of course it's not going to reinfect. The bugs are just superficial. They haven't got time to set up a whole new colony. They haven't got time to form a mature lesion.

And look at it in terms of life experience. It will actually change a patient's complete experience because they're no longer subjected to quite austere measures to keep these teeth nice and sterile. It's like, hang on a minute. Perhaps we've gone slightly overboard in what we've been taught because we didn't have those tools then. Now, we've got tools to very simply sterilize the surface.

And it's probably only going to take about thirty seconds. Now, it's actually worthwhile changing the treatment protocols and saying, "You know what? It's actually not quite as complicated as it used to be because now we've got additional steps we can do, which are very simple and very fast."

So, it really does change, not only the clinician's understanding of what caries is all about and how to treat it and what a filling is about, but it also changes the patient experience.

We were very fortunate. At Belfast University, we had one of the professors called Ruth Freeman, who worked in child psychology. And we invited her to become part of the research group and start to write papers with us because she went to the patients afterwards and started to ask interesting questions about their experiences with dentistry.

And the feedback we got was that the patient and the mum were very fearful right at the start. The child became more fearful because of the mother's past experience. And we've heard it. You only have to stand by, say, a doctor's surgery door. A small boy is walked in by mum. And what does she say? "Don't worry. It's only a little injection. It won't hurt."

If I was a four-year-old, I'd be screaming my ababs off, and I'd be out like a shot because, first of all, mum says it won't hurt. That means it probably did in the past. And secondly, it's an injection. And I've heard all sorts of horrible stories about that.

Whereas, now, after ozone treatment, what we found was a complete shift. Mums started to talk in terms of, "I want that for the rest of my children. I want that for myself." And, of course, the child is looking at mum saying, "You said it would hurt. It doesn't."

So, I think I'm not sure if I sent you one of the pictures. But, somewhere in my file, I've got a picture of me treating a small boy. He is fast asleep and snoring his head off. I mean, he just got so bored that he'd gone to sleep. And, that, I think, was probably some of your children's experience when I was treating you and your family. And you suddenly discovered that actually dental care doesn't have to be quite as invasive and nasty as it used to be.

And so, it's changing people's perceptions, and it really is showing population groups that that traditional fear of the dentist and the drill and the amputation process and the smells and everything else are really in a bygone era, and, thankfully, belong there. The problem is there's still vast numbers of dentists who can't shift or who don't want to shift. And that's the real issue.

Will: Right. In time and with more public education, the more people who hear about this and turn around to their dentist and say, "Hey, are you thinking about using ozone in your dental practice here?," then the more people saying that in the industry, the professionals will respond.

Dr. Holmes: Yeah. To go back to your question, which is, "So what are the areas?"...I practice a full scope of dentistry. If I am doing oral surgery, i.e. Cutting tissue and taking wisdom teeth out, uncovering bits of root or whatever, ozone has a part to play. And not only in causing a blood clot to form, but also in terms of tissue healing.

So, we use ozone as a pre-mouth rinse, so ozonated water. That will eliminate bacteria, which, potentially, could cause deeper tissue infections. We use it as an ozonated oil actually at the time of surgery. So, if I've got a piece of bone or a

socket, which is uncovered, I will actually syringe ozonated liquids into that socket. And the healing phase after I place my stitches, I will send my patients with ozonated oil, with quite detailed at-home instructions on how to use it to accelerate the healing process and to keep that stitch line and the suture lines nice and clean and sterile. So, when they come back, you're taking stitches out of healthy tissue rather than inflamed and very infected tissue.

Things like periodontal treatment. There are a lot of papers, some dating back to the 1950s and beforehand, detailing how ozone and ozonated water and some of the ozonated plant oils could be used to treat periodontal pockets. So, myself and a research team in India have been releasing a number of papers, scientific papers, which meet all the scientific criteria for publishing in the international journals, showing how the use of ozone either in trays or on a swab stick can accelerate the healing process, how it can kill the disease process which is associated with periodontal disease, and also how those ozonated fluids can be used to combat acute sensitivity after, say, gum surgery.

So, ozone has a part to play, as I alluded to earlier, in virtually every single facet of dentistry. It really depends on the individual clinician to jump in and accept the research for what it is, and just go for it.

We all did that when we trained. We didn't really question whether or not we should be using rotary drills. We did because that's how we were taught. In a modern era, we tend to be much more hesitant and reluctant to try new technologies, especially where some of the long-term results are hidden from view. So, if I as a practitioner who have used ozone for the last fifteen plus years,

I can look at a cavity. I can clean it by hand. I can ozone treat it. And I will put in the final filling.

Now, when I lecture, I teach dentists either to do the same in the expectation that is what they will see three or four months down the line. If they're unwilling to take that risk, as it were, because they don't have that experience that I do, then there is an alternative, which is to put in a temporary filling or like halfway house filling, which will keep on releasing minerals into that softened area. And at three months, they bring the patient back, they take part of that filling away, have a little feel around, and inevitably they will find completely hard remineralized tissue there. And then they put the final filling on top of that.

So, a lot of it is please believe the research because it's actually out there. And It's not just me. It's Edward Lynch. There are hundreds and hundreds of papers now, which has been published from the 1950s onward about the use of ozone in dentistry and medicine. But it's also changing the patient's perceptions in that, okay, you're not going to get your final filling today. But, the advantage is we haven't had to destroy two-thirds of your tooth. We've only had to take away five percent.

Will: Right, which is huge! I mean thats a big paradigm shift. But, nonetheless, the implications, like you said, are the cost of the tooth over the life of the person. That's gigantic!

Dr. Holmes: Yeah. You're trying to preserve as much of the inherent strength of the tooth as possible. You have to remember, Will, that as soon as you cut into a tooth, you cut through, not just a simple crystal structure. You actually cut through

different, almost collagen fibers on the interior part of a tooth. And that simple little cut down to create a cavity can reduce the strength of that tooth by 60% to 65%. And that's a small filling!

So, some of these large fillings, you actually have zero strength left in the tooth at all. So, if you over stress it, say you've been down to the pub and on your way home, you get a bag of peanuts and you hit a piece of shell, you can dismantle the tooth in double quick time. Or you hit a bit of grit in the carrot you just dragged out of the fridge. A lot of patients have done that. And all us have experience eating a bit of grit. Fortunately, most of us don't lose bits of tooth.

But for those that do, it's horrendous and it's a nightmare. That tooth is going to be really sensitive and it's going to hurt. And it may have to be taken out. And then what do you do? Then you've got to go down and suddenly your cost of ownership has gone from a simple filling. Now it's an extraction. Now you've got to figure out what you're going to do with the space.

Will: So, before everyone goes to run out and purchase home ozonating equipment, can you offer a word of caution on that? Or what's your advice on that?

Dr. Holmes: Home ozonation units, I think, have a fantastic part to play in the at-home care. But -- and this is the but -- if used correctly, they will be tremendous beneficial to oral health and to general health, as well because you can use ozone, say, to combat athletes foot -- it's just a fungal infection, after all -- ingrowing toenails and toenail overgrowth, just a fungus that gets into the toenail. You can use it to treat, say, stings and bites from insects. And, of course, if you

make ozonated water, not only can you rinse your mouth out as part of your oral hygiene sequencing at home, but you can also use it to wash your vegetables, depending on how far you want to take the sterility bit.

The word of caution, I guess, is try and buy a good quality ozone unit which comes with instructions. So many times, I see these units for sale. The translation and the instruction manual which comes with it is quaint English, to say the least, usually translated by somebody in darkest -- I was about to say Africa, but that would be unfair -- usually darkest China.

So, it's quaint. You look at it and you tend to throw it away, so you actually miss the essential protocol of actually how to use it. It's just an operating manual telling you how to turn it off and turn it on again. So, there are lots of resources on the web which will give you good working protocols.

And, for those listeners who want working protocols, I'm happy to provide you with general protocols. But, because there are a multitude of different ozone equipment and generators out there, it would be very difficult for me to give you an exact protocol using that exact piece of equipment.

But, in terms of side effects, you can use it in every single facet of your household. You can use it to treat your pets, your animals, your horses, your sheep if you have a small holding. You can use it in your vineyard to sterilize your water lines. You can use it in your aquarium to combat fungal infections in your fish. If you're a farmer, you can use it to remove the pollutants in your groundwater runoff. As I said before, it has a use in virtually every single facet of

not only dentistry and medicine, but in healthcare and in healthcare management, as well, and in just general household management, too.

Will: Right. That sounds like definitely a cutting edge as far as something... I'll be optimistic and say in twenty years, we'll see in many, many households.

Dr. Holmes: I would certainly hope so. We already see a dentist who I know in Australia. He's actually put an ozone generator into his water feed into every single piece of equipment. So, now, as soon as a patient comes in, they are already treated with ozone.

I know practices in the states, the company which I own, we design a small room ozone generator. There are dental practices which have these hanging in their offices so that when you come in, if you have a cold, you're not going to spread it to the team, and likewise the team is not going to spread bugs to you, too.

So, what we're trying to do is put in very basic health care, but, also prevention, as well, which, possibly is more important than the actual health care part itself. Because if we can prevent disease, not only in the mouth but also in the general population, that has to be a much better idea.

Will: Sure. One final question for you, Dr. Holmes, before we close this up. What's the bad news? I'm sure there's some bad PR out on the internet. Somebody's going to go, "Oh, wow, ozone in dentistry," and type in "ozone in dentistry" on Google. And what are they going to find and how do you want to rebut that?

Dr. Holmes: [Laughs] First of all, they're going to find a huge number of different research papers showing the benefits. But, also, in terms of ozone in general, they're going to find some very interesting claims, which would be difficult to scientifically substantiate.

So, in terms of general health, it's not going to magically make you feel better. It will combat some of the more age-related life-threatening diseases. And, it potentially will improve your general health and well-being. I would say do your research with care. And if you've got questions, ask them.

There are a whole range around the world of different ozone societies. And I'm the president of the International Association of the Use of Ozone in Healthcare and Dentistry. And we're holding a four-day international congress in Las Vegas next year. If you go onto the web and if you search for the www.IAOHD.org, you can view who's coming to lecture.

We have specialists in dentistry, in medicine, and in environmental control. We have participants who are vets, therapists. We have professor Silvia Menendez who is probably the most respected ozone researcher -- and she runs the ozone clinics in Havana in Cuba -- going to be at conference and to lecture, as well.

So, there is an opportunity for people who are interested to actually come and listen and ask questions from the leading people. And the whole concept which I have as president of this association is that it's all about sharing knowledge. I've got 30 years worth of clinical care knowledge locked away in my brain cells. Professor Edward Lynch has the same. Silvia Menendez has the same. Frank

Shingur has exactly the same. But, we very rarely talk to groups outside our immediate profession.

So, at this meeting we've got doctors talking to dentists. We've got vets talking to dental researchers. We've got industrial pollution control specialists talking to groups of doctors and therapists. So, there's a real opportunity to see what research in other fields, which as a professional group, you possibly wouldn't be aware of, how it can be used and how it has influenced the way in which we think and the way which we use ozone and manipulate it in the different professions because without that exchange of knowledge, it's going to stay static and blinkard. And part of my remit is to open up the debate and the talk and the sharing of knowledge throughout the all these disciplines.

Possibly, I've bitten off more than I can chew. But I do believe in the next two years -- which after two years, I think I shall probably want to willingly give up the presidency by that stage -- I hope that we will have made a real impact and a real sea change into how ozone is viewed on by the professions on an individual basis and how it started to be looked at. That what we're doing in dentistry is actually no different to what we're doing in medicine or in agriculture or in veterinary care or in any other facet where ozone is used because wherever research is done, there is always a spinoff into someone else's.

Just a really quick point before we end, Will. Nearly 150 years ago, an English surgeon called Miller did a lecture tour of the states. And he talked about a theory he had of how infection in the mouth have long-term effects in Alzheimer's, dementia, heart and chest issues. And that was taught in the United States and also in English medical schools up until about the late 1940s.

And then it all disappeared. Nobody actually had the scientific tools to either disprove or prove it. So, because it wasn't really evidence-based, it got sort of pushed to one side and put down as one of these old theories, which couldn't be proven, so, you know, we won't talk about it anymore

Well, in the same way that the Scripps Institute came along and showed us that white blood cells actually do produce ozone in the body, contrary to what the FDA would actually have you believe, it's actually not so damaging for you. So a group of scientists in the states have started to show that diseases of the mouth, and especially periodontal disease. is associated with dementia. We're seeing an increase in viral diseases, which are associated with oral cancers. We're starting to see research which is showing that low-birthweight children are a result of the pathogens which are found in advanced periodontal disease in the mouth.

Socrates and a number of other founding fathers of medicine used to say, "The mouth is a mirror of what's happening in the body." And science is, at last, actually showing us and proving us that that is exactly so.

So, potentially, ozone has a part to play in your oral hygiene because if we can eliminate these bad bugs -- and you can test for them by doing a simple DNA test now -- you use ozone as part of your treatment in your at-home protocol. You start to put in place really advanced at-home care which could have life changing experiences for you.

So, instead of expecting to become demented in your nineties -- because that's about how long we expect to live now -- we're going to be maybe frail, but we'll

actually have completely copus mentors. And we'll be able to remember what conversation we had two days ago.

Will: Right. So do you have any closing comments or suggestions for the listeners, Dr. Holmes?

Dr. Holmes: Yes. The web is a fantastic research tool. So, do your research well. Ask questions. And don't be afraid to ask your doctor, your dentist, your therapist about ozone. If you're not happy with the response you get, use the web to either find out of a clinician who is close to you or use the web to find a resource where you can ask questions. And for those of you who really want to know what is current and what research is being done and how it potentially could help you in your life experience, come to the congress in February 2013, next year, Las Vegas.

Will: So, two points here I'd like to have you touch on. First of all, where can folks find out more about you and your work, as well as if somebody wants to find particularly a dental practitioner that utilizes ozone, where would they go to find that information?

Dr. Holmes: Okay. Actually, it's the same source. To find a practitioner or to find more about ozone from a research point of view, www.The-O-Zone.cc. In that web address, you will find a vast number of research papers. Most of them are full articles, but there's also a series of abstracts which you can read. There's both medical, veterinary, and dental research there.

If you want to find products, there are a huge number of people who make ozonated plant liquids. I would say look for producers who can produce scientific evidence that their product is being tested and is registered with a recognized health authority. There aren't very many. And I only know of two to date where their products have been tested and are tested on a regular basis, and also have an official recognition from a health authority.

So, do your research. Ask questions. My email is spread throughout the web. So if you want to ask questions, DrJulianHolmes@gmail.com. I try to personally answer all the mail that I get. And if I can't, I will direct you to somebody who can.

There are ozone groups on the web which you can join. You would need to do a little search. There's one for the healozone, and one for ozone in general. They're two groups which, basically, I moderate and which I set up about ten years ago. I know of about four or five others.

Most countries have a local Ozone Association. So, there's one in Spain. There's one in Europe. There's a pan-European ozone association which most of the doctors belong to, and a few dentists. The association which we founded earlier this year is designed not just for doctors, but it's designed for, basically, all participants in ozone, including manufacturers and therapists and doctors and dentists and vets and everyone else.

So, there is actually a lot of information out there, Will. I guess nobody's ever really had the time to collate it and put it together because I think that is a job within itself.

Will: Sure. Wow. Thank you. Thank you so much for bringing this crucial, cutting-edge information to us. I really appreciate your time, Dr. Holmes.

Dr. Holmes: It's been a real pleasure, Will. And I hope, if you have a chance to get across to Las Vegas in February, you'll come across and meet the rest of the team because there will be some very interesting people there. And, people who I think your group would also benefit from, as well. People like Silvia Menendez because she really does lead the world in terms of research on a medical basis. Chris Kammer who we were talking about briefly beforehand, he is one of the founding fathers of the American Association of Oral Health. He, too, has a complete protocol for gum disease. And ozone is part of that treatment.

Some of the papers which people can find that either I've authored or authored in association with those looking at the role of, say, the herpes virus and all disease and the instance of cancer. There's a lot of research saying the medical world, which simply hasn't crossed over into dental or some of the other professions.

So, this is part of my role, I guess, as president of the International Association, is getting these groups to talk together, putting together some research protocols, which we can then, actually, produce new information, which collates information from lots of different sources and brings it into a central location for, not just the clinicians, but also for the general public, as well.

Will: Yeah. That sounds like a truly a once-in-a-lifetime gathering of people.

Dr. Holmes: Well, when I put the speaker list together and sent it out a couple of days ago to the board, somebody came back and said, "This reads like the

Who's Who's in healthcare!" And I said, "It's actually better than the Who's Who's. These are the 'Who Who' people!"

I actually wrote to the board members and I said, "You do realize this is a one-time life event. We'll probably never get these people together again in one location over four days." It would be impossible to do that because one or two are quite frail. Trying to entice some of these practitioners out of their own countries is hard enough. Putting them on an international flight and putting them into Vegas, I think, is possibly the ultimate challenge for a lot of people.

And I'm not quite sure why, but all our keynote speakers have accepted. And they're all going to be together in the second week in February in Las Vegas. And I'm looking forward to the most amazing congress because there is so much shared experience and the potential to better people's lives is huge!

Will: Wow! Thank you, thank you, thank you!

Dr. Holmes: Not at all, Will. It's been my pleasure. If you guys listening have any problems and they start to ask you questions, just send them on to me and I'll do what I can. Because like I say, if I don't know the answer, I know people who potentially can.

Will: Perfect! Thank you so much!

Dr. Holmes: Not at all. Have a really good evening. And to all your listeners, thank you very much for bearing with me over the last hour and a bit. And I hope to meet some of you, as well.