Hyperbaric Oxygen Therapy as an Adjunct Healing Modality:
A Special Interview With Dr. Jason Sonners

By Dr. Joseph Mercola

JM: Dr. Joseph Mercola
JS: Dr. Jason Sonners

JM: Welcome, everyone. This is Dr. Mercola, helping you take control of your health. Today we're going to discuss a therapy probably you've heard about before but is widely underutilized. It's hyperbaric oxygen therapy (HBOT). Here with me to discuss that fascinating topic is Dr. Jason Sonners, who's been doing this for about a decade. Welcome and thank you for joining us today.

JS: Thank you, Dr. Mercola. I'm happy to be here. I'd love to share information on hyperbaric oxygen.

JM: Why don't we start explaining what it is? Because many people have heard of it. There are a lot of details to dive deep into to help people further understand it because there's a wide variety of applications. But my guess is almost everyone watching this would benefit from it on a regular basis if they're interested in optimizing longevity. But even if they're not for the treatment of certain conditions, which you'll discuss, I mean there are incredible bonuses for it and benefits. It's a great alternative to some of the really challenging interventions that are used or typically used for common problems that are loaded with side effects and are relatively ineffective because they're not treating the cause. Why don't you start diving deep?

JS: Sure. I mean on its most basic premise, hyperbaric oxygen is literally the application of breathing either air or oxygen under pressure. You're inside some type of pressurized device or hyperbaric chamber. Due to the pressure, you're exposing the body to a higher percentage of oxygen. You could also increase that oxygen by piping oxygen into the chambers. As a result of that environment, you're increasing the body's capacity to absorb more oxygen than what you and I can get here at 1 atmosphere (atm) at this conversation.

JM: Yeah. A really simple way to explain that is the pulse oximeter, which measures the oxygen saturation in your hemoglobin. If you're healthy, it's probably 98% or 99%. That means you really can't shovel up more oxygen on hemoglobin molecule, like 1% or 2% more.

JS: Exactly.

JM: Why don't you explain how the increased pressure of oxygen supplies more oxygen to your tissues?

JS: Sure. Yeah. That's a great example. It's the the pulse oximeter. Basically, if you have no lung or heart condition, most of us are carrying about all the oxygen we possibly can: 96%, 97% or 98%, which means you only have the capacity to carry about 2% or 3% more. Let's say we had a green tank and a mask, you could fill that void.

JM: Green tank is an oxygen cylinder for those –

JS: Sorry?

JM: A green tank is an oxygen cylinder.

JS: Right. Yeah. Exactly. If you had a medical-grade oxygen and you were breathing that indirectly, you could fill that 2% or 3%. That's about it. There's literally no way to increase oxygen beyond that – 100% is 100% – unless you're under pressure. Being under pressure, there are two main laws – there are a few more – but there are two main laws that govern how that works. It's Boyle's Law and Henry's Law. Basically it just says, "As you take a gas and you exert pressure on it, you could make the size of that gas take up less space. And then as a result of that pressure, you can then dissolve that gas into a liquid."

An easy example is like a can of seltzer. They're using carbon dioxide and water. But basically, you can pressurize that can, so you can put carbon dioxide into that can. As a result of that pressurization, you can dissolve molecules of carbon dioxide into the water. Well, in the hyperbaric version of that, we're using oxygen, and the can is the chamber. But as a result of dumping excess oxygen inside that chamber, you can dissolve that into the liquid of our body, which for us it's directly into the tissue and it's into the plasma of our blood. Normally our blood does not carry oxygen. We rely wholly on red blood cell oxygen-carrying capacity. But inside the chamber, you could literally bypass the red blood cell oxygen-carrying capacity altogether, and you could absorb oxygen directly into the tissue.

JM: Thank you for explaining that. But people are likely wondering, "Well, why? Why do I want more oxygen in my tissue?"

JS: That's a great question. My background is – I've done a lot of functional medicine and nutrition in my life, so I look at this primarily as a nutrient. You know this just as well as anybody, we can go days, weeks – we can even go months without food. You know, we can go a couple of days without water. But we can't barely go a few minutes without oxygen. We need about 100% of the oxygen that we're capable of carrying every minute of every day just to perform normal functions. So there's very little room for creating an excess of oxygen for the sake of healing or helping some of the conditions that we'll talk about later on.

So the way I look at it is nutritionally. Let's say vitamin C. If you didn't get enough vitamin C, you'd have a deficiency. We call that scurvy. There are consequences to having a deficiency in vitamin C. Likewise, there's an optimum range of vitamin C that you would try to get every day just to make sure that you have enough to perform all the tasks that you're going to ask vitamin C to do inside your body every day. And then there's a period that you might choose to megadose vitamin C; maybe if you have a cold or if you're doing intravenous (IV) vitamin C drips. There's basically – In nutrition, there's deficiency, which has consequences. There's optimum range, which is allowing us to do what we need to do every day. And then there are periods where we need a surplus of that nutrient to help us deal with some issue that we're having in our health or in our life.

I look at oxygen the same way. If you're not getting enough oxygen, whether that's globally because of a lung or heart issue or if that's locally because of a trauma, like a traumatic brain injury (TBI) or some type of injury, you could have an area of your body that has oxygen deficiency. We call that hypoxia. If you have a deficiency of oxygen, it's hypoxia. There's an optimum range of oxygen, which for us is virtually almost 100% of our oxygen-carrying capacity, every minute of every day.

And then periodically, we might choose that we want to create a surplus of oxygen because oxygen is the fuel that literally runs our body, right? It helps us detoxify. It controls inflammation. It runs our energy production. I mean, we'll get into all the details, but oxygen is the fuel that we need. Sometimes, we might need more than the optimum range to help us get over some sort of health issue, or like you were referring to earlier, from a quality of life, longevity, regenerative medicine-type standpoint, that excess oxygen could be really magical for people just from a healing capacity.

JM: Yeah. I would disagree with the concept that it's a fuel though. It's an important component for the fuel. But the fuel are really the foods that we eat, the carbohydrates primarily and the fats. They break down

essentially to form acetyl coenzyme A (acetyl-CoA). That gets transferred into the inner mitochondrial membrane, to the electron transport chain, which requires oxygen as the ultimate electron –

JS: Right. It's the last electron receptor.

JM: So if it's not there, you're not going to be able to burn that fuel. Essentially, all this fuel will back up. It is obviously a critical component of the process and many people are depleted in. Why don't you discuss now the reasons or diseases that someone might consider having this treatment done? Because there's quite a number. There's probably at least a dozen, if not more, that are actually medically approved that insurance will pay for.

JS: Right. I mean we have to look at it from the standpoint of, in my opinion, healing period. If you want to heal and heal faster than whatever situation someone's in, or if inflammation or if there are health issues that are really compromising the healing process, any of these concepts would benefit from it. But to go into detail, there are about 14, I think in the States, about 14 approved diagnoses. Internationally, I think there are somewhere between 70 and 100 actually reimbursable indications for hyperbaric oxygen. But in the States, we reserve it for pretty tough cases: really bad infections like gangrene, osteomyelitis, radiation burns, certain neuropathy, like diabetic neuropathy is an indication, chronic wounds that are not healing or not healing with traditional attempts at antibiotics and things like that.

We primarily – In the States, from an insurance standpoint and a hospital standpoint, we really reserve hyperbaric oxygen for cases that aren't responding to whatever typical and traditional treatment would be. Outside of that, there's an enormous range of people who benefit from hyperbaric oxygen that don't qualify for one of those 14 diagnoses. Honestly, if you really look at the physiology behind it, the people who benefit from it are similar to those of the 14 indications that are approved, but they're just less severe. All kinds of autoimmune conditions benefit from it. All types of neurologic conditions, like concussion, TBI, dementia, all types of musculoskeletal injuries, even broken bones, torn muscles and tendons and disk herniations. I actually got into hyperbaric initially because of a disk herniation that I have.

[-----10:00-----]

If the idea is that we need to control inflammation, if we need to improve the rate of healing, if we need to improve mitochondrial function, all of these are going to be very solid indications of people who would respond very positively to hyperbaric. But that brings me – I think we should talk about this since we're bringing it up. Hyperbaric is the word that describes a therapy of under pressure. But there are different types of chambers too. You would use different types of chambers for different types of conditions.

JM: Yeah. Let's delay that discussion. I don't want to extend this one further. I think it's almost medically reprehensible, inexcusable and malpractice for a physician or clinician treating a patient with diabetic neuropathy, infections in the distal extremities or peripheral vascular disease, that the patient is a candidate for amputation and doesn't use this as a modality. I mean you're essentially sacrificing the patient's limbs because of this ignorance. I mean in your case or your experience, what percentage – I mean obviously, ideally, it's best to have the person metabolically controlled, with [inaudible 11:37] happen in most diabetics because the physicians are clueless on how to treat diabetes. But what percentage of your diabetics are able to avoid an amputation?

JS: We don't. That's not a huge population just in our own personal office. Typically, hopefully in most cases, we're getting to these people well before we're facing amputation levels. Exactly what you said. Obviously we do similar work in the vein of blood sugar control and getting their diet in check. We're doing a lot of work chemically to try to improve their scenario.

But virtually, all neuropathies, whether they're early stage diabetics, which we will treat quite a bit of – They have some loss of sensory. They may have some motor loss, but they're not typically facing amputation. I say that the few dozen of those who we've had, I don't think we've had a case that actually got amputated. I mean the response rate is unbelievably high. But the other issue is, in traditional medicine, utilizing hyperbaric, let's say for a non-healing wound, I don't remember exactly, but for the most part, you need to go through, I believe is, four rounds of increasingly strong antibiotics over the course of I think five or six months before you become a candidate for reimbursement for hyperbaric.

We're talking about a therapy that is basically breathing oxygen under pressure, that the side effects and consequences are virtually nil. The people who are contraindicated to go into a chamber are a very small number of people. It's a very safe, insanely effective therapy that, in many cases, even in those extreme cases. We're delaying patient opportunity for healing. Which, to your point, it's just the state of, I guess, where we are health care-wise today.

JM: Okay. One of the indications you mentioned that has really intrigued me and which is why I actually purchased a chamber myself is the mitochondrial dysfunction. "The ability to improve mitochondrial dysfunction" would be a better way to state it, which I think is fascinating because in my mind, mitochondrial dysfunction is really one of the fundamental basic defects that occur in almost all chronic degenerative disease. If you can help recover your mitochondria, you're going to go a long way just to essentially immunizing yourself against disease.

JS: Yeah. I mean the list of effects and benefits of hyperbaric oxygen is long. Mitochondrial changes are definitely a big part of that. A couple of things to know, one we were talking about the electron transport chain. It is the final acceptor of electrons. In some cases, they were wondering, "If you improve – When we're looking at adenosine triphosphate (ATP) production, is it that we're not getting enough raw materials?" – The things you were talking about, like medium-chain or short-chain fatty acids, "Or is it a glucose issue? Are we not dumping enough into the system or can we not get along with the electron transport chain properly? Or if we had more oxygen at the end of that to accept those final electrons, what are all the implications to improving the efficiency of mitochondrial ATP production?"

As it turns out, once you expose the body to increased levels of oxygen – It's called oxidative phosphorylation, right? The whole oxidative phosphorylation, the whole ATP and energy production system of our body increases its capacity to produce ATP and to produce energy. But even more important, which I think is critical, especially in these chronic degenerative diseases, is that let's say you could even only get a mitochondria to be maybe 70% or 80% effective, under the longer term hyperbaric exposures, the body will actually increase the size of the mitochondria. It will change the shape of the mitochondria. It will increase the density of mitochondria. What will happen after long periods under hyperbaric exposures, more like – Just to give you an idea, that's like 20 hours or 40 hours of exposure – what you're going to end up getting, you're going to get up getting more efficient, bigger mitochondria, and you're going to get a lot more of them.

Even if you're stuck at like 80% efficiency, if you had twice as many mitochondria, producing 80% efficiency, you're still going to get a much better output for the patient. I think the capacity there for improving these chronic illnesses is really tremendous.

JM: Alright. Before we go into the way that you administer this – because we've got plenty of time to discuss that – I still want to go over the benefits on what it does. There's a few of them that we really haven't touched on. One is the microcirculation or the capillary growth in your body, which tends to decrease with time. But time when you're 50 or 60, you start noticing pretty radical decreases in recirculation. That is a foundational reason why you're going to get sick. The particular ones of interest to

me are the ones that supply the satellite stem cells of the type II muscle fibers. Your muscle – just to remind people – consumes anywhere from 40% to 60% of your tissue in your body. It's a big, big player.

The reason why the decrease in the microcirculation to these stem cells is an issue is that as that decreases over time, especially over 60, you lose the ability to gain muscle mass, because those stem cells need a blood supply. I do some blood flow restriction training. In fact, I trained you when you were at my house. But there are only two things that can increase that microcirculation that I'm aware of. One of them is blood flow restriction training. The other is hyperbaric oxygen because it works in the same mechanism. Because when you get out of the chamber, you have actually relative hypoxia, which induces hypoxia-inducible factor 1-alpha, or HIF1A for short, which then stimulates VEGF, vascular endothelial growth factor, which is the fertilizer for growing new blood vessels.

To me, that's one of the most exciting aspects, especially when it relates to improving the capillary density of the heart and the brain, the two tissues or organs that tend to go out most frequently and contribute to the largest percentage of morbidity, I believe, in the population.

JS: Yeah. I think, to your point, the damaged microcirculation. We're talking about capillary beds. We're talking about in capillary beds. That's where gas exchange occurs, which means that's where the circulation system is delivering oxygen to the working tissue, and then the working tissue is dumping carbon dioxide back into the circulation and heading out. One really important thing to note is that with almost all chronic inflammation, with almost all trauma, with a lot of the background physiology in chronic illness, there is a tremendous amount of microcirculation damage, which leads to the inability to fuel the tissues, so that it can heal. And for the ability to carry away the waste products of that tissue, so that it doesn't become over-inflamed.

The issue there is that in the capillary, red blood cells need to line up single file in order to have that gas exchange occur. But when the capillaries are damaged, that can't happen. I think that's why we see such an accumulation of inflammation and degeneration over time.

[-----20:00:-----]

The biggest difference here with hyperbaric oxygen is because you're basically dissolving excess oxygen into the plasma of the blood, where there is microcirculation damage, right away, day 1, hour 1 of your first session, you're already increasing perfusion of the tissue, because oxygen couldn't get through, because the capillaries were damaged. But plasma gets through. If plasma gets through after a hyperbaric session, that plasma is now carrying oxygen. And now all of a sudden, whatever tissue that was damaged, that was literally hypoxic, is now becoming reperfused with oxygen and, all of a sudden, starting to heal. That's the short-term version.

The long-term version is exactly what you said. As a result of being in a hyperbaric environment, which is hyper-oxygen, you're going to increase oxygen levels. When you get out, you're going to decrease oxygen levels. That increase-decrease of oxygen is what stimulates that HIF-1 that you were talking about and the VEGF. That's where you get literally regrowth of microcirculation. When you're talking about nerve damage, when you're talking about brain trauma, when you're talking about wounds, even internal wounds like Crohn's and colitis, where there's just a tremendous amount of inflammation, there's a tremendous amount of circulatory damage, and this tissue just can't get the oxygen that it needs, this is a complete game changer, because it's delivering oxygen through a different mechanism. That mechanism is not stopped by the increased inflammation and decreased capillary perfusion. And so all of a sudden, you're just literally feeding this tissue and waking it up and getting it to heal.

JM: Well, thanks for expanding on that. The other benefit that you didn't touch on is the activation of stem cells. I was skeptical when you first shared this with me. I looked it up and sure enough, it's very clear in the literature.

JS: You didn't believe me?

JM: No. I didn't. I've got to double-check everything. It's well documented that this radically improves stem cell activation. Just to give people a reminder though, stem cell therapy typically is a five-figure intervention that's not covered by insurance. You're going to pay 10,000 to 20,000 dollars. Why do that when you can do an intervention that's safe and has all these other benefits that's going to activate all your stem cells and probably provide similar if not even better overall therapy benefits?

JS: Yeah. It's not just because we were talking about musculoskeletal stem cells. It's also nervous system stem cells.

JM: Right. I was talking about the microcirculation to increase the function of the existing ones. But yes, it also increases other stem cells.

JS: Exactly. In our office, what we would do – We don't do stem cell injections or IV or anything like this. But through all the other modalities too, with various fasting techniques you can change, stem cell releases also, if you go into stem cell therapy where you're going to spend 5,000, 10,000, 15,000 or 20,000 dollars, but the environment of your body is virtually unchanged, it's really hard to get those stem cells to behave in any other way than your tissues are already behaving. If you actually go through the process where you're correcting all the other biochemistry and you're getting the inflammation under control and then you're megadosing oxygen, besides the fact that you're creating an environment internally that's going to support the stem cells, you're already upregulating your own stem cells.

Even if you choose, let's say, to do some type of stem cell therapy, I believe if you upregulate your own stem cell system and then add a layer of stem cells to do that, your body is already in the process of getting ready to utilize them. The effectiveness is going to be tremendously higher. In a lot of cases, we have seen that people don't need to do that therapy if they give the oxygen therapy a long enough shot.

JM: Yeah. In my view, it's really irresponsible if you decide for whatever reason that you need stem cell therapy. That's fine. That's your choice. But if you go that route, just go with the next step and get some hyperbaric after you have those stem cells injected. Why don't you just provide your recommendations for someone who is getting a stem cell injection or stem cell therapy as to the frequency and the timing of those hyperbaric treatments?

JS: Sure. In a perfect world, I'd say you'd spend at least a month or two before stem cell therapy, like understanding – Not even just for hyperbaric, just understanding your whole whatever. Is it an inflammatory cascade or other chronic illness that you have? So that you're already starting to shift the internal environment in a way that's going to be conducive to the new cells once they're injected. We, typically from an oxygen-only standpoint, I would typically run somewhere between 10 and 20 hours before, because that's where you're going to hit the mark where your body's going to start upregulating its own stem cells.

If you're going for stem cell retrieval so the doc's actually going to pull your own stem cells, if you go through a hyperbaric oxygen, let's say about 20 hours before, your retrieval's going to be a much higher retrieval because you've already started to release a lot of your own stem cells. So usually somewhere between 10 and 20 hours prior to a stem cell therapy, and then definitely a minimum of 20 but usually 40 hours post- to really make sure that they're going to be able to take hold and do what they need to do to change the physiology for you.

JM: Thanks. I didn't realize there were so many. I just thought there might have been a few. But thank you for expanding on that. That pretty much ends what I'd like to discuss on the benefits and the reasons why you'd want to consider. Hopefully we intrigued some people enough that they're interested. "Well, how do I get this?"

Before we go into the ways that you can get it though, I want to talk about a similar therapy that many people confuse with hyperbaric. That's one that I was actually looking for a while, but I stopped since I got my chamber. That is EWOT, which is an acronym for "exercise with oxygen therapy," which usually involves using an oxygen concentrator that goes into a large bag, like a 50-gallon bag that fills up with oxygen that you breathe in while you're exercising. Why don't you address the differences between hyperbaric and EWOT, because I suspect many people would have a question about that.

JS: Yeah. Sure. That's a good question. To some degree, more oxygen is better most of the time. I like EWOT also, but they're very different therapies. I think that they do very different things. I think – I've read a lot, especially online – maybe it's in advertising – comparing the two. I just don't think that they're comparable from the standpoint that the model of how they work and what they're ultimately going to feel are very different. Just for some comparison's sake, EWOT is exercise with oxygen therapy, so with exercise. EWOT is an active process. Hyperbaric oxygen is a passive process. With hyperbaric oxygen, you're literally typically sitting or lying down and you're just breathing. Especially in some patient populations, you can't even express the level of exercise that you would need to in order to gain some of those benefits. That's one difference.

But the primary difference I would say is that with EWOT, which is still a great tool from the standpoint of your increasing demand, so when you exercise, your heart rate goes up and your respiration rate goes up. You're breathing heavier and your heart rate's going up. And so what that means is that your body is saying, "Listen. I need more oxygen so I'm going to pump faster and breathe harder so I can get turnover of those red blood cells that are carrying the oxygen to the working tissue." With EWOT, you're basically increasing demand through exercise, and then you're increasing supply through the oxygen concentrator that you were describing. You have this big bag of oxygen.

Instead of – Right now, everybody listening to this, you and I are breathing air, which is 21% oxygen. In that concentrator, maybe it's 97%. Now you're sitting on this bike. You're exercising. You're creating a deficiency of oxygen because you're at least creating a demand for more oxygen. Instead of breathing 21% oxygen like you normally do when you exercise, you're going to breathe 97% oxygen, so you're going to have a higher supply. Increased demand, increased supply generally will equal an increased absorption.

A big issue though is that you're still completely relying on that red blood cell oxygen-carrying capacity. If you have an issue that is trauma-related, that there is chronic inflammation, that there's damage to the microcirculation, a lot of these conversations that you and I have been having so far, there's nothing about that excess oxygen that you're creating through supply and demand that's ultimately ever going to change that. The only way you're going to change that environmental issue and especially the microcirculation, the HIF1, the VEGF, all those pieces that we were talking about –

JM: Stem cells.

JS: Right. The only way that's going to happen is these megadoses, these exposures to oxygen and pressure. What we're finding is that it's not just the level of oxygen absorption. Some of our epigenome is pressure-sensitive. Pressure alone increases the pressure that also stimulates some of these healing responses. The biggest difference is that one is active and one is passive. One is still relying on red blood cell oxygen-carrying capacity, one is basically bypassing red blood cell oxygen-carrying capacity. To some degree,

they're both increasing oxygen, but I don't think you could really compare it. I mean hyperbaric is definitely increasing oxygen capacity to agree that it's pretty significantly higher than anything else that exists.

[-----30:00-----]

JM: Okay. Just a slight comment on the 97%. It's probably closer to 93%.

JS: It depends on the rate.

JM: Yeah. Because normally you'd crank it up to 10 liters per minute with typically the concentrators they use. The higher you crank it up, the less –

JS: The less oxygen. Exactly.

JM: But probably 93%, which is still significantly higher than the 21% in the air. But another thing I wanted to go on before we go into the types of chambers that are available and how one would access them is the issue of treating infections. You touched on it briefly with diabetics, but it's not just diabetic infections. This is pretty much any infections. Because there are so many of us who had these chronic infections. Lyme would be the classic example. I'd like you to discuss how the hyperbaric therapy can be useful for these chronic infections. In my review of longevity research, it seems that the older you get, the higher the likelihood that these infections are going to take you out. It's not necessarily a heart attack or the cancer. It's just these infections.

JS: These subacute infections, ultimately leading to other brain, heart or circulatory damage, for the most part, I think to summarize that component. I mean, think about it as something as terrible as gangrene. You know, there are anaerobic infections. Anaerobic infection means that these are bacteria that live in zero-oxygen environments. They actually thrive. The lower the oxygen, the more they thrive. That's an anaerobic, versus, let's say, a lot of our probiotics, like the good bacteria in our body are either aerobes – they like oxygen or they're at least oxygen-tolerant,

And so with a lot of these pathogens, Lyme being one and C. diff – They're doing some research on them now too. A lot of these pretty tough pathogens that are anaerobic, they don't tolerate a high-oxygen environment. When you go into these pressurized hyperbaric chambers and you're breathing and absorbing these higher levels of oxygen, they literally act as a natural antibiotic.

They help to – They do two things simultaneously. They help to kill the anaerobic bacteria, because they can't tolerate those high levels. They also – The high-oxygen environment helps to break down some of the biofilms that a lot of these anaerobes use to protect themselves. But at the same time, they're literally feeding and helping your own immune system, whether that's through increased neutrophil-macrophage stimulation or that's through literally feeding the healthy bacteria, the other part of our immune system, so that the parts of our body, the white blood cells and the probiotics are going to thrive. They're going to do really well and you're going to get a little stronger on your immune system yourself. You're also going to help kill the anaerobes, the pathogens that are responsible for a lot of these subacute infections.

JM: Well, you addressed the bacteria, but I'm particularly intrigued with the viruses, which may be even more of a pervasive threat because they're not aerobic, facultative aerobic or anaerobic. They're dependent because they thrive inside the cell they're infecting. The only way that you're going to address that is somehow improving and stimulating the immune system.

JS: Stimulating your own immune system. Right.

JM: Can you discuss that?

JS: Yeah. I was hinting at it before. But there's a very strong – Again, two sides of the coin. One, you're going to have a very strong effect on the standard cytokine cascade, the inflammatory cascade that our body goes through during certain either traumas or infections. There's going to be a decrease in interleukin 1 (IL-1), interleukin 6 (IL-6), interleukin 8 (IL-8) and tumor necrosis factor alpha (TNF alpha). You're also, at the same time, going to get a massive increase in neutrophil and macrophage stimulation. You're literally going to stimulate an increased production of white blood cells. That's what our body uses to fight infections.

The aerobe-anaerobe thing affects bacteria, but I would say also, a lot of different mold and fungal infections. Between mold, fungus and virus, you're going to see an effect I think globally from the massive increase in white blood cell stimulation from a body-fighting-infection standpoint.

JM: Okay. I think we've laid the groundwork to provide a very intriguing argument for the benefits of receiving hyperbaric oxygen chambers. Now we can address, "How does one receive it?." The brief, short summary is a soft-shell chamber, which you can easily purchase it in your home. I mean, not easily, but it's doable, compared to hard-shell chamber, which is less easy. Why don't you discuss the differences and the benefits of each? Because there's a lot of confusion on this.

JS: Yeah. Sure. I'm going to start on the other end of the spectrum, the more invasive, and then I'll go into the least invasive.

JM: Sure.

JS: Those 14 indications that we were talking about that are insurance reimbursable, some of those are also topical, like the gangrene and the radiation burns, like severe radiation burns or necrotizing fasciitis where you're in the hospital –

JM: Flesh-eating bacteria.

JS: Yeah. Those chambers are hard chambers. All that means is that they're capable of higher pressure. In those cases, you might be going well beyond even 2 atm and 3 atm, even beyond. And the chamber itself is literally being filled with 100% oxygen. The way that the chamber is being pressurized is with oxygen. That process, which is really primarily delivered in a hospital setting, sometimes that level of pressure and that level of oxygen, for those really tough cases, is important. Sometimes having the fact that the body's literally soaking in oxygen, because the only air in that chamber is literally 100% oxygen, sometimes, that's meaningful, especially if it's a non-healing topical wound of some kind.

Now, in those chambers, you know, oxygen is not really flammable. It's an accelerant, but you have to be very careful with sparks. You're wearing cotton scrubs and you can't bring anything inside the chamber. There are all kind of regulations around that, because there are certain safety concerns when you're looking at that type of chamber.

The next version down would be a hard chamber. But instead of filling the whole hard chamber with oxygen, you're using air to create pressure, and then you're piping oxygen in separately so that you can breathe oxygen, whether that's through a concentrator or through medical-grade green tank oxygen. But the ambient oxygen in the chamber doesn't really exceed mid-30s to low-40s. You don't really ever get to a point where the inside environment is a safety hazard. You can wear basically whatever clothing you want. People do bring electronics if they want into the chamber. You can bring a book. The restrictions are

much lower. The safety is much higher. But the effectiveness of the treatment is identical, especially for most internal issues.

JM: And the costs are lower.

JS: Things like that. Those types of chambers are pretty readily available in private clinics. You can go to a private clinic and get that type of treatment. And then there are soft chambers. Soft chambers are limited in terms of pressure. In the U.S., you're only allowed to go to 1.3 atm, which is about a relative 15 feet underwater, 12 to 15 feet. It's not very high. It's about 4 or 4.5 pounds of force per square inch (psi). But you could still absorb quite a bit more oxygen in that chamber than you could standing here, having this conversation. It's still meaningful. It might mean that in certain cases, we're going to do more frequency, longer duration.

The way we look at it in the office is oxygen, pressure and minutes. Those are the three variables. You could increase or decrease pressure. You can increase or decrease your percentage of oxygen. You can increase and decrease the length of the actual treatment itself. In a hard chamber with 100% oxygen, you might not need as much, or you could do it a little less frequent, depending on the condition. With a soft chamber, with an oxygen concentrator, let's say, maybe you're just going to end up doing more frequent treatments, more often longer durations, maybe 90-minute or two-hour sessions instead of 60-minute session. That kind of a thing. There are certain conditions like infections, especially sometimes when you have acute Lyme, let's say, or C.diff. There are certain doctors who – let's say with stem cells – really believe that higher pressure is really important.

There are certain conditions where – Just to give you an idea, the soft chambers go to 1.3. In an office like ours, we might use 1.3 for certain issues, 1.5 or 1.75. We don't really ever go off two. We'll treat some people at 2 atm, which is about 33 feet underwater. But in those chambers, there are certain conditions that you're better off being in a clinical environment to get them treated. And then there are a lot of conditions that if all you had access to was a 1.3 with a concentrator, you can still make a lot of progress, especially, I would say, neurologic conditions, like concussion and TBI –

JM: Autism.

[-----40:00-----]

JS: Autism. Exactly. Cerebral palsy (CP). There are a lot of chronic either degenerative, developmental or traumatic types of neurologic conditions that they respond really, really well to 1.3 atm with an oxygen concentrator.

JM: Yeah. I think one of the conditions we neglected to mention is one that's killing, I believe, close to 1,700 people every day in the United States, and that's cancer. Obviously not approved for cancer, but certainly there are a large number, perhaps even a majority, of natural medicine clinicians who focus on treating cancer who integrate this into their protocols.

JS: Yes. And then depending on the research. A lot of the research of recent has been done by Dr. Thomas Seyfried, specifically on glioblastomas. That type of therapy is typically done at 2 atm, 100% oxygen. So we're looking at sort of a, "I'm going to a clinic for that. I'm using that as a tool for let's say a pretty aggressive tumor, higher pressure and higher percent oxygen."

At the same time, again, this is about healing. We've had patients in our office who we've worked with or other patients who we come into contact with or other doctors, because we're in touch with a lot of clinics

across the country where it's not even – Some of them are using it as a method to help with or augment the cancer treatment itself. Some are using it as a way to, again, heal.

There are consequences of chemotherapy. There are consequences of radiation. It doesn't have to be third-degree burns. Even if you're just looking at it from the standpoint of a recovery tool to help – The idea with most cancer treatments, I'm sure you would agree, is we're trying to get more selective with the cell type we're killing, but we're trying to kill cells. Hopefully, the person survives that process. If you're augmenting with hyperbaric oxygen simultaneously, the idea is that you're also helping to heal the tissue so that the healthy tissue can still survive, or even higher percentages of healthy tissue, can survive and even thrive even though we're getting treatment on, let's say, the other side with chemotherapy or radiation.

I think there are a few different ways, even in traditional medicine, which is really interesting. Now, they're looking at this a couple different ways in the research. One is to say, "Listen. If we're doing hyperbaric simultaneously, on one end, could the patient get away with less radiation, less chemo and get the same outcome?" That's one avenue of research that's looking very positive.

Another avenue that they're looking at is to say – In some cases they might say, "I wish we could do more radiation, but the patient can't tolerate it." One of the avenues that they're looking at is to say, "Well, if they're doing hyperbaric oxygen simultaneous with the radiation and they recover in between sessions faster and can they tolerate more so that they could get the therapy that they feel they need on the radiation side, at the level that they feel they want to use it, because the hyperbaric is helping them heal in between sessions." The last way would be, "Hey. What is hyperbaric doing on cancer all by itself? What are the benefits? Can we use that as a primary tool in treatment for cancers?" Those are the three totally separate avenues.

JM: Yeah. Let me just comment on the last one. The reason why it's focused on that is cancer cells, for the most part, rely primarily on a very primitive form of energy generation called anaerobic fermentation, which typically occurs in bacteria, where you've got the sugar coming in, the sugar molecule breaking down the pyruvate. Then pyruvate, instead of going into acetyl-CoA and being shuttled into the mitochondria with oxygen to create energy, it goes directly to lactate. It's a far less efficient way to create ATP, but that process does not require oxygen. These cells are relatively sensitive to oxygen toxicity. So that if you can get them deprived of glucose, which is the primary method, but also glutamine, which is another strategy that Dr. Seyfried uses, and hit them with oxygen, it works like a one-two punch. Of course there are a lot of other modalities that can be integrated into that equation, but that's a powerful synergy.

JS: Right. I think back when we got started – We've been doing this for I think about 12 years. There was a really big concern back then. "Hey. If you're increasing blood vessel growth, is that going to stimulate cancer?" There was a lot of pushback on even supplementing hyperbaric oxygen with cancer patients. Exactly what you said, it's turning out that, yes, you get angiogenesis. You get more capillaries. But these tumors aren't growing more blood vessels to get more oxygen. They're growing more blood vessels to get more sugar.

If you can get the blood glucose levels balanced out, exactly what you were describing – If you can create a glucose deficiency and you can create an oxygen surplus – I mean, literally, these cells are not adaptive, right? Most of our cells should be able to tolerate different fuel sources, different oxygen levels and still be able to live. These cancer cells are pretty primitive. They're pretty weak. They just need the right combination. If you deprive them of glucose and you massively increase their oxygen, they literally can't live in that environment. That's the strategy behind a lot of the cancer treatment. It seems to be showing really a lot of positive results on really aggressive tumors. Similarly, I think we'll find through the research as well – but we see it clinically already – that that same concept would be true for even less aggressive tumors.

JM: Let's get back to the chambers, because I want to refine some of the details you mentioned. You talked about the 100% oxygen chamber, which has its intrinsic challenges and can potentially ignite and explode, like it did in Apollo 1 where it killed the three astronauts on the first Apollo space craft. They're almost identical situations. I don't know if they were pressurized, but it was 100% oxygen for sure. That is an expensive process and, as you said, typically done in the hospital. The range for that treatment per session is about 400 bucks or so. I'll let you describe the –

JS: It's much more than that. I think in general, hospitals get close to 2,000 or more.

JM: Okay. Well, I was thinking more of private clinics. But if you're in the hospital, of course everything is exploded. That's just the nature of the beast.

JS: Right.

JM: But it's very expensive. But if you go to private clinicians, it's going to be closer to 400, like yourself. But if you take the less risky and just use a concentrator or even a green tank oxygen that you're breathing in instead of 100% oxygen, you eliminate the explosive potential. You also radically reduce the cost, like closer to 100 dollars per session.

JS: Right.

JM: Go there, and then we'll go into the soft chambers.

JS: Sure. Across the country, it ranges. But soft chambers or hard chambers, not piping in 100% oxygen, the range is probably anywhere from as low as 90 to probably about 180 dollars an hour. Most clinics, like even ours, if somebody's going to do – because very few people come in and do one session.

JM: Yeah. It doesn't make sense to do one session.

JS: Right. You're going to do 20 or 40 sessions. And then it gets down closer to like 120 range pretty consistently for multiple sessions – 130, something like that. It becomes a lot more reasonable because safety is much higher, exactly what you mentioned.

JM: Yes. For literally – I mean in many cases it's not covered. There are only 14 limited cases in the United States. It's different worldwide, of course, where it's covered by your insurance company. But even if you're paying out of pocket, I mean it's crazy. Literally for a few thousand dollars you have a life-changing modality that exceeds the potential of most conventional recommendations and strategies for your illness. I mean it's just – I know some people can't afford that, but it's in the budget. And certainly, the complications of not having your illness treated properly and suffer the side effects –

JS: What's the cost of not getting better, right?

JM: Yeah. I mean it probably far exceeds the cost of the therapy.

JS: Right. You know, clinically, we used to do whatever – There are a lot of different things that we're running in our office. We used to do our typical protocols. When people weren't responding the way we expected them to, we would introduce hyperbaric oxygen. At this point, it's become literally one of the first things that we do. Because if we do that early on, so many of the other therapies that we used to have to do, we don't need to do anymore.

JM: Yeah, yeah. It's just a really effective intervention and one that is somewhat novel with respect to anti-aging strategies and longevity. There are groups in Israel, which I believe are the leaders in this. They have these what's called multiplace chambers where they have 10, 20 or 30 people fitting in one chamber breathing the oxygen and the pressure. They're doing a lot of the longevity research out there.

JS: They're doing a lot of the research. They have waiting lists beyond waiting lists of people to use it, just for longevity or regenerative medicine-type standpoint.

[-----50:00-----]

JM: Let's go to the soft chambers now, because I think that is something that many people may want to consider. I want you to discuss those. Because within the soft chambers, there are two types. You mentioned that the U.S. Food and Drug Administration (FDA) in the United States has restricted the pressure to 1.3 atm, which is still reasonable. But there are some soft chambers that can withstand 1.5 atm, which is a more ideal concentration. Probably, there are very few conditions that would need more than that. If you have a chamber that can go up to that level, there's actually a little simple hack that's not legal, but you can talk to the manufacturer of the valve, where you can actually get a replacement valve to let that 1.3 go to 1.5.

JS: If they're built. Just to clarify that –

JM: It has to go up to 1.5.

JS: A lot of them aren't even built to even do that. Definitely, I wouldn't recommend that, obviously, for those. But listen, again there's the U.S. and then there's the rest of the world.

JM: Yeah, yeah.

JS: In the rest of the world, they make soft chambers that go to 2 atm. It's a possibility to exceed what we're doing. There's a limitation in the FDA that say soft chambers – Technically anything 1.4 and below, I think is considered a soft chamber. But yes. So soft chambers are capable of 1.3 in the States today.

JM: Legally.

JS: Even that, again, the difference between 1.3 and 1.5, there is a difference, definitely, but especially for anti-aging or regenerative medicine, especially for those neurologic conditions that we were talking about before, whether it's from trauma or chronic illness, they respond really well. The thing is this, even if you're travelling, even if you live a town or two away from a clinic like mine, if you're doing four to six hours a week, you're coming to visit me like three, four or five days a week sometimes, even if you're a local, that's not very convenient. To some degree, people choose to do the soft chambers because they can have those in their house. It doesn't matter if they're doing a 90-minute or two-hour sessions, because they're saving time not driving back and forth. For some people, it's just a convenience matter. For other people, it's just what they can get access to. But there's still a tremendous amount of benefit.

You know, some of the researchers, even in the States, they started doing this research – I think it was in Russia at first. I mean, they're doing research on 1.1 and 1.2. They're starting to show some research even in the States now where some TBI cases, they're even looking at lower pressure, like 1.2 because the body has to react to the pressure and the oxygen. And so to some degree, this 1.1 to 1.3 range, it almost allows the pressure to be unregistered but the oxygen levels will still go up. There's almost no guard. The body doesn't put a guard up. If you go to 2 atm, 100% oxygen, you get a decent amount of vasoconstriction right away. At 1.3, let's say with or without a concentrator, I don't think there's any, actually, vasoconstriction, or if there is, it's minimal. You're almost able to set in –

JM: Why don't you talk about the downsides of vasoconstriction? Because to me, it would sound like a negative. But it might be a positive because it's almost like exercise. You're constricting, and afterwards you expand or dilate.

JS: Right. There are two pieces. Like if somebody had a blood loss anemia, which hyperbaric is also fabulous for, or any type of anemia, I mean obviously anemia's consequence has a lot to do with oxygen. But if you have a blood loss anemia and you have leaky vessels, that vasoconstriction is actually really helpful. It actually helps to control the amount of leakiness of those broken blood vessels. There are times where that vasoconstriction is beneficial.

Also, like we talked about the HIF1, hypoxia-inducible factor, that sometimes it's just like exactly what you said, bouncing back and forth, allows for an epigenetic change that's also beneficial. So having some vasoconstriction, vasodilation and vasoconstriction, in certain cases, you might run red light therapy to get nitric oxide dumping so that you could even contrast vasoconstriction versus vasodilation that way. There are benefits to it. At the same time, to some degree with vasoconstriction, you could also decrease some of the oxygen that's ultimately ending up wherever it's going. For some of these chronic, especially chronic neurologic diseases, if the body doesn't recognize it and it puts up very little of any defense against it, the amount that could be absorbed into the needing tissue could be really high.

JM: Okay. Good.

JS: Another condition that we really didn't touch on is post-stroke. It's that same constant, right? If you had a stroke of any kind, you're going to have a centralized area of tissue damage. But then you get that whole surrounding area that virtually becomes dormant. It's that same idea with the microcirculation damage. The tissue doesn't get enough oxygen to wake up and perform tasks. But as soon as you start flooding it through the plasma, you get enough oxygen where it literally, that area that was surrounding the stroke just starts to shrink. You could measure that on a single photon emission computed tomography (SPECT) scan. They've done a lot of research on that. You could watch brain metabolism. You could watch areas of little or no metabolism at all completely regain normal function after exposure.

JM: I think it's crazy post-stroke not to integrate that into the equation. I think what you're referring to is reperfusion injury.

JS: Yeah.

JM: Which also is application for post-MI.

JS: Yeah.

JM: So for stroke and for MI.

JS: They've done research on six months to I think three years post, and they get great results with all of that. What they're starting to look at now is how quickly can we actually implement it safely and actually minimize some of the consequences in the first place. I mean –

JM: What does the new research show?

JS: It's catching up.

JM: How soon can you start post-stroke?

JS: How quickly? Clinically – Okay. In the research, I can say we don't know yet. I would say the sooner the better. If you're safe about it – In other words, you don't go post-stroke right to 2.5 atm, 100% oxygen, right? You can build that up slowly. But the sooner you can get that level of oxygen into the body, the better that's going to be. I think they're looking at trying this by exactly where that line is. I would say that most commonly, you have someone who has a stroke. They end up going through some type of really intensive, let's say, hospital-type therapy.

And then they end up in some type of outpatient therapy. There is no hospital that I know of that will implement HBOT, so they're not getting it there. And then they go to outpatient. We get a lot of phone calls from people in outpatients saying, "Hey. Can we get into the chamber or can we get a chamber brought to the outpatient?" We have not found one that will let us bring a soft chamber to them, and only if they have transportation can they get to and from. It's typically usually somewhere between that three-month on, where people are now home. They're still getting some therapies, but they're really stuck in terms of their progress, where they really start reaching out and trying to look at what other opportunities or options they have. That's where most people – I would say who we came to contact with, are able to begin a meaningful regimen of hyperbaric oxygen.

JM: Yeah. To me, that's another medical negligence. This needs to be integrated in almost all post-stroke rehabilitation. It has a really good claim.

JS: In the hospital.

JM: It really is possible. Yeah. I'd like to actually address the issue of the oxygen concentrators. The typical concentrator puts out oxygen at about 93% to 95%, but at a limited pressure, which I think is throttled by the FDA in the United States. I forget the specifics, but it's like 1.5 atm, which should be like 14 psi.

JS: Not even.

JM: It's 10 psi?

JS: I think it's 10.

JM: Okay, 10. That is not a meaningful number. It may sound like an obtuse tangent, but it isn't. Because if you were piping oxygen in through a concentrator, not medical-grade oxygen, which is a totally different story, but through a concentrator, the higher the atmospheric pressure you have, the less oxygen that's coming in. Unless you bypass the FDA, go to China and get an oxygen concentrator like we did that goes up to 100 psi, we'll feed that chamber even 3 atm.

JS: Right. Yeah. Even in the U.S., they make oxygen concentrators, I want to say, even up to probably closer to 18 to 20 psi, which you could use theoretically up to almost 2 atm, maybe 1.75, really. But they're only made for fish ponds. They're not made for medical-grade usage. As you said, they're not FDA-approved for medical usage, so you really can't use them in our setting that way. Yeah, most likely, similar to the idea that the soft chambers, although capable of more, are limited to 1.3 or 1.4. The oxygen concentrators are also limited to about 10 psi at 10 liters. To get – I think it's literally possible to get a 30- or 40-liter concentrator, which is what you would run. You know, the medical oxygen that we could run into the chamber will typically run at closer to 30 liters per minute at 20 psi or more if we need, or 40 psi if we need to. But yeah, it's a limitation of what's allowed with the regulation.

[-----1:00:00-----]

JM: Okay. I think probably the next step is to help guide people through the process of identifying a center close to them that can provide this treatment and maybe even discuss some of the options they could look at for purchasing. But for most people, they don't have to purchase one. You can just easily find one close to your house. But then you do run into the inconvenience aspect because you're looking probably at a minimum of 40 treatments. If you're considering this for a longevity program, it's pretty much a lifelong program.

JS: Right. What I would typically say to people is that you do a regimen in a clinic if you have access to it. Certain issues. Think about it like, "If it's a disease that has a beginning and an end or if it's trauma, any trauma, even TBI and concussion or disc herniation, whatever benefits you get from the therapy, you keep," versus against a degenerative disease, like dementia or an autoimmune condition. Or if like what you're saying, we're using it more from like a more regenerative standpoint. That's going to be something you're going to use ongoing for long periods of time. Then you should own one.

But if it's something that you just want to see, "Hey. How am I going to do? Am I going to respond to this?" Most treatments, you would start to see changes around 10 hours. Somewhere between 10 and 20 hours, you kind of know if it's a good fit for you. And then from that point, you can have, with guidance of the practitioner, you should be able to figure out a baseline of what your protocol should look like. It's really more either you don't have access to it, you can't get to it, there's not any center near you or the issue that you're trying to work on for yourself, for your family, is something that's degenerative in nature. Ultimately, you're going to be using this thing for years and years, then you're better off, in most cases, just to have your own.

JM: Okay. Guide people through the process of finding a high-quality local center. What do they need to look out for?

JS: Unfortunately, it's really hard. For most places, if you Google "hyperbaric oxygen therapy in your area," whatever hospital near you is what's going to pop up.

JM: Well, probably nothing now, because Google essentially banned all natural health practices. Just use an alternative search engine.

JS: But the hospitals, even if you had cash and you wanted to pay them, hospitals will not treat you if you don't have one of the 14 FDA-approved indications. We've got a lot of those types of phone calls where someone's saying, "Do you treat this? Because I've called four places and nobody will treat this." Primarily, that's just because in the hospital setting, they treat the 14 indications and pretty much nothing else.

To find a center, you're just going to be looking up hyperbaric oxygen. You're going to be looking in the private sector, because those are the only people outside the hospital who are going to treat these other indications.

I would say that the IHA, the International Hyperbaric Association, and the HMI, the Hyperbaric Medical International, those are the two big organizations in the U.S. They're basically like non-profit groups that are in charge of helping educate the public on the use of hyperbaric oxygen specifically for indications that aren't the 14 typical FDA-approved. They have a tremendous amount of resources. They also probably help direct people. I'm almost sure of it, to be able to find centers that they know of that might be more local to them in their area. That's probably the best. And then otherwise, like I said, you'd be looking at different manufacturers that produce chambers and how to get those into your home.

JM: Okay. If someone was interested in seeing you locally, if they live close to where you're at, where's your clinic at and what's it's name?

JS: It's New Jersey HBOT. We also have one in Philly. PA, Pennsylvania Hyperbaric and New Jersey Hyperbaric are two of our clinics.

JM: Alright. Great. Well, you've certainly been a mentor to me and helped be understand this valuable therapy that I think more people need to be aware of. I think you've provided us with a pretty comprehensive understanding of the benefits of this and then some of the ways that it can be administered. I greatly appreciate your conversation.

JS: Thanks for having me. I appreciate your time, Doc.

JM: Alright.

[END]