



Virtual Reality in Medicine: A Clinician and Patient's Perspective

Talking to VR Medicine News, Sarah E. Hoffe, MD, the Section Head of GI Radiation Oncology at Moffitt Cancer Center and Associate Professor in the University of South Florida Morsani College Of Medicine's Department of Oncologic Sciences describes her interests in virtual reality (VR) and its applications in gastrointestinal (GI) radiation oncology.

VRMN: Thank you for joining us Dr. Hoffe. For non-imaging experts, just to clarify, can you first explain the difference between VR and 4D imaging?

Dr. Hoffe: 4D is something that we do in traditional medicine. I am a board certified radiation oncologist, and I've been doing this almost 20 years, but I specialize in GI cancers and the reason that's relevant is because most of the cancers that I treat move with breathing. Every time I treat an esophageal cancer patient with radiation, I have to consider where the tumor is when the patient inhales and where is the tumor when they exhale. At Moffitt Cancer Center, we use a machine called the 4D CT scan that takes pictures at each location of the patients' anatomy through all phases of the breathing cycle.

That's relevant because I can gate the radiation treatment; so I can essentially turn on the beam only when the patient exhales. That's a sophisticated form of radiation that allows us to take positioning of the tumor with time, with reference to time.



Sarah E. Hoffe, MD

VRMN: Great thanks. Can you describe your interest in VR?

Dr. Hoffe: Sure. To give you some context--three years ago, I reached out to Jeff Hazelton, who co-founded [Biolumid](#). His company was acquired by [Sharecare](#) (owned in part by Dr. Mehmet Oz) in September 2016. Doctor Oz is very much into virtual reality and their company is trying to do all these things to move the needle forward.

VRMN: Yes, I understand they are trying to make a "Google Maps" for the human body?

Dr. Hoffe: Yes. A few years ago, Jeff and I started talking about the patient experience and about how difficult it is for patients to understand their illness. I made a leap and I said, you know, there's something in the literature called the patient activation measure and this is intellectual property from, I believe, the University of Oregon where they're able to ask the patient a series of questions and figure out where the patient is on the

spectrum—so, is this somebody who is really savvy or is this a patient who says “what's cancer?” We see that spectrum in practice and my premise to Jeff was “I think visual information can really help activate these patients, particularly the ones that have no understanding at all.” We've been working together on that premise.

Long story short, I worked with Jeff to develop a pancreas app and right now it's on an iPad. They were creating this anyway but I just redirected them and said “can you do pancreas next because I treat pancreas cancer.”

I'd like to initiate an Institutional Review Board study where I would check patients' learning preferences at baseline to see how they learn, and then I give them the app and see what's the best way for them to learn. It could be video, versus an app which is tactile, versus something else. We're planning a clinical study on all these things. I'm trying to roll it out into the clinic but in a way where I'm studying the effects of it.

Jeff had been working on virtual reality applications for 20 years. I brought in the patient whom I treated for pancreatic cancer. He was able to go into virtual reality to see the pancreas, and it looks like a painting, that's how pretty it is. The patient was able to literally stand inside what you see on the app and so that in virtual reality he's standing next to the artery. In pancreatic cancer, the issue is that the tumor sometimes cannot be removed because it sits adjacent to a blood vessel, so in virtual reality he was able to see, “Wow now I get why the cancer couldn't be removed. Look it's right next to the blood vessel.” (See the article below for the patient, Mr. Tucker's perspective on this.)

The patient said, “If I had seen this at day one when the surgeon was talking to me, that would have really changed my life,” and this is a very educated man, “Because I didn't understand why I had to have radiation before the operation. I didn't understand all this.”

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Fast forward to the present, I'm designing what I call the GI clinic of the future. My vision is I want the patient and the surgeon to be able to go into virtual reality together and the family can be behind them and see it on a screen. The surgeon will be able to explain the tumor and its location to the patient.

For me, it's a matter of an immersive experience. Yes you can talk to a patient with audio or you can show them a video. Yes, I can even show them an iPad that's tactile, but I believe that the future is an experience where the patient actually walks around and really immerses themselves in what's going on. My premise is that I think the more this is done, the better outcomes will be possible. Patients are more likely to be compliant with the instructions that I give them before treatment; they're going to understand what the issue is, and my premise is I think we'll find long-term that they have better outcomes.

VRMN: That's great. I think it's now possible also to recreate a patient's tumor from 2-D images, correct?

Dr. Hoffe: Yes, at Moffitt, we're very interested in extracting images from patients' x-rays because we think the future is an imaging biomarker profile where you can extract textual features from CT, PET or MRI, and you can look within a tumor and create all this information. It's a new field called Radiomics. Robert Gillies and Robert Gatenby at Moffitt have been investigating mathematical oncology, radiomics and image extraction, and we've just submitted a protocol for pancreatic cancer where we will use the pathology and the radiology to correlate and see what the image tells us.

In oncology there's a lot of hope about radiomics and about imaging biomarkers. Hopefully, it will help us take two very similar patient CT scans—perhaps at an identical stage--and then be able to do a textural analysis and determine distinct survival rates and treatments for each patient.

VRMN: What do you think will be in clinical practice in one to three years--do you think these approaches will be more widely used?

Dr. Hoffe: I think now that people like Doctor Oz are proponents of it, I think patients are going to drive it.

VRMN: Yes, absolutely. My prediction is 2017's going to be the year where that starts really happening. Do you agree with that?

Dr. Hoffe: Yes, 100% and that's the biggest thing. When I finally realized that my collaborators, Biolucid, who are absolutely incredible--that Doctor Oz's company bought them--that to me, that was the paradigm shift. I was like okay, wow, this is going to hit mainstream. I have been getting what Biolucid has been doing for three years and I've tried my hardest to push it within mainstream medicine but, I came across a lot of obstacles. Well those obstacles are going to be crushed by Doctor Oz putting it on his show once a month. It's just going to be a different ballgame.

VRMN: Do you have any additional comments about how augmented reality (as opposed to VR) might play a role in medicine?

Dr. Hoffe: We haven't done any augmented reality projects, but I think that's also very interesting. We're starting with VR, but being a science person I would love to validate this approach because I know the criticism will be, "Well why should we put VR in the clinics? We don't really need that." It'd be great if we can start producing some randomized medical education research comparing iPad versus VR and evaluating various outcomes, such as compliance and other metrics.

VRMN: Sure, absolutely. What other applications do you think VR could be used for?

Dr. Hoffe: There's so many other applications of this technology for patients. For example, VR could help relax patients who are receiving radiation therapy. I could look at their blood pressure, their heart rate, I can see if VR has an effect on getting them into a relaxed state. Patients have so much anxiety waiting for chemo or waiting for a scan. I think we

can save a lot of money not using mood-altering drugs and change their experience--change their reality.

Virtual Reality: A Patient's Perspective

John Tucker, aged 70, a retired financial advisor living in Palmetto, FL, was diagnosed with pancreatic cancer in October 2009. Treated at Moffitt, he underwent tumor resection, performed by Mokenge P. Malafa, MD, followed by chemotherapy under the care of Gregory M. Springett, MD, followed by radiation and chemo by Sarah E. Hoffe, MD. Fortunately, Mr. Tucker has been cancer free since the treatment.

Dr. Hoffe asked Mr. Tucker if he would try out the VR demo of the pancreas to help understand the potential role of VR in patient education. "Most people have no idea where the pancreas is located or how hard it is for surgeons to get in there and get to it—that's why it's such a difficult surgery," Mr. Tucker told *VR Medicine News*. "I was able to see what they would show a new patient--starting in the front, where all the organs are. You can look through it as various sections are peeled off," he said. "Depending on where your particular cancer is, they can show you where it would be inside your own body. I was able to get to the back of the image, and I could walk around it and see all around it."

According to Mr. Tucker, for the average patient--the more that they understand about the disease, what it is and how it would be treated, the better they will be prepared to deal with it, and fight the disease. "Knowledge does help. This, I think, would be outstanding as a patient education tool."

He added that it's important to realize, however, that there will be patients for which this cannot be used. "When I was getting treatment, a lady came in who had been diagnosed with pancreatic cancer and she literally could not stop crying in the treatment room," he said. "But the majority of patients once they have gotten over the initial shock, could be helped with this tool," he said. "They would have a better understanding of what the physicians are saying. Without VR, all you have is drawings or a handheld flip chart. Pictures do a better job than words."



Mr. Tucker in the studio with an intern from Brown University.