

Hearing Health Hour: Measuring Tinnitus and Reactions to Tinnitus

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>> ANIL LALWANI: Well, hello and welcome to our Hearing Health Hour webinar. And thank you for joining us for another research presentation from Hearing Health Foundation. Today we're going to learn about tinnitus.

If you're new to Zoom, please review the technical guide that has been shared in the chat. Please note this event has a live captioner. You can enable closed captioning by clicking on the CC in the toolbar at the bottom of your screen.

By way of introduction, my name is Dr. Anil Lalwani. I'm a professor and vice chairman for research in the department of otolaryngology as well as associate dean for research at Columbia University in New York, which is my background. I'm also a Board member at Hearing Health Foundation, where I oversee the Emerging Research Grants program, also affectionately known as ERG. These grants have made it possible for many leaders in our field to become successful scientists.

Today we're going to hear from Dr. Richard Tyler who received an ERG grant himself from the Hearing Health Foundation back in 2012. He serves as professor and director of audiology in the department of otolaryngology and department of communication sciences and disorders at the University of Iowa. He's published over 270 articles, that's a lot, on tinnitus and his work focuses on research studies that help tinnitus patients. If I personally have a question on tinnitus, my first step is to do a quick search on Dr. Tyler's publications. I can usually find my answers there.

Tinnitus is a frustrating condition. The next theme of Hearing Health magazine is Tinnitus and Hyperacusis. I'm excited to read it and I hope you are too. Of course all of our work on tinnitus as well as all other hearing and balance conditions is only possible

through the generosity of supporters like you. And if you would like to support our work on hearing loss, tinnitus, and related conditions, you can do so today at hhf.org/donate. And without further ado, now we're going to move to the presentation by Dr. Richard Tyler on measuring tinnitus and reactions to tinnitus. And we're going to have Q&A at the end. Thank you, Dr. Tyler.

>> RICHARD TYLER: Okay, thank you. I hope I can be helpful here and of interest. Tinnitus is actually quite common and there's opportunities to help people. And part of that often begins with understanding and measuring it.

So, the first slide here I refer to as our psychological model of tinnitus, which we developed back in 1992. And in that, it is important to make the distinction between the tinnitus characteristics itself so it has some sound like pitch and loudness and duration and the annoyance caused by that tinnitus. And we'll talk quite a bit about the different reactions that people can have, different for different people. But the important point here is the reactions depend not only on what the tinnitus sounds like, whether it's loud or soft, but also on the psychological characteristics or makeup of the individual who gets tinnitus. So, we're all different. We have different backgrounds and different experiences and that has a role to play in the overall annoyance that one gets when one ends up with tinnitus.

So, it's important to measure tinnitus for several reasons: For the patient, for the clinician, obviously essential in research and sometimes I even do legal cases and propose some of the measurements.

So, for the patient here, many of the patients come into the clinic and they're concerned what is this? Why did it happen to me? Is it real? Do I have some mental issue, am I making this up? So, it's very important to show the patient, to show people that in fact this is real. You have a sound that's not supposed to be there. And we can measure it. And most of the patients also have a pure tone threshold loss. We usually start off with the audiogram showing them that their hearing loss is probably related in some ways to their tinnitus, in most cases at least. And remember the average normal hearing is 0 dB HL. So, some people with hearing thresholds of 5 dB HL may actually have a pure tone threshold loss. It's important to show the patient as a first step what their hearing is like and how that might be a factor in the disorders of their auditory system that is causing tinnitus.

So, for the clinician, it can be very helpful for us to help with management. We can use the measurements in terms of counseling. We can use the measurements to determine the severity. And in some situations, we can also help design and focus on the treatment that is needed depending upon the measurements that we get. This is particularly important in our tinnitus activities treatment that the counseling strategies that we've used that focuses on the four different possible components of tinnitus that includes the emotions, hearing, sleep, and concentration. So, most people with tinnitus have some emotional issues, most of them have difficulty hearing, sometimes caused by the tinnitus, sometimes caused by their hearing loss. And many also, but not all, have problems with sleep and with concentration. We want to be able to monitor the progress with our measurements. And in addition to this, many of the clever devices that are available these days to help people with tinnitus might require measurements such as the spectra that is effective, the level of the noise needed, whether one can mask the tinnitus in one ear or both. Whether the tinnitus gets worse or better when you take a masker off. It's important for our clinicians, as well, to be able to measure tinnitus.

So, again, I'm going to focus on two different areas here. I'm going to focus on the measurement of the tinnitus itself: The pitch, the loudness, and the masking, and the measurement of the reactions to tinnitus and the primary functions affected are thoughts and emotions, hearing, sleep, and concentration.

So, keep in mind that all measurements have some variability. So, measurements are not perfect. Some of it is just the procedure and test/retest. But it's more complicated in tinnitus patients because some tinnitus patients change over time. And sometimes we have to be aware the test stimuli we're using can change the tinnitus. We try to address the variability that person is experiencing, and if we can, the source of that variability, as well.

So, the psychoacoustical testing of tinnitus involves pitch matching. That is we're going to match the pitch of my tone to the most prominent of the pitch of your tinnitus. Even though the tinnitus might sound quite complicated like a hum or a buzz, it can usually have a prominent pitch. So, we'll do that by providing two options of pitches and I'll go into that in a minute. We also measure the loudness by asking the patient to judge the loudness of their tinnitus to the loudness of my sound. The third approach is minimal masking level. So, we're going to put in a Broadband noise usually and we're going to increase the level of that noise until it just masks the tinnitus, if we can do that. And the

last one we refer to as residual inhibition. And that is we can produce a noise for a few seconds, for example 60 seconds, to cover up the tinnitus and then we can turn that noise off to see what happens to the tinnitus after our noise is turned off. We'll talk about that, as well.

So, pitch. Well, the pitch match of the tinnitus might be related to the audiogram, what's causing the hearing loss, and maybe what's causing the tinnitus. And it may be that we can change the patient's pitch, which is related to spontaneous activity and relating to a pure tone, maybe we can get more focused on that. It may be helpful for fitting some devices. For example, we suggested early on you could use narrow band noises in some cases to mask the tinnitus knowing what the pitch match could be, we can move a noise overtop of that prominent pitch. And there are also strategies where there is a notch in music or notch in noise that is a frequency region of the noise or music missing. And that might be needed to put that notch over the pitch match frequency of the tinnitus. That's another reason why pitch is important.

So, we use focus on the most prominent pitch, even though the tinnitus might sound like a cricket. There are several methods available. But as I usually say, try and keep it simple. Important to measure the pitch with a monaural stimulus, going to one ear, because some people have diplacusis, a different pitch in each ear. You can do this test in the ipsilateral or contralateral ear. But pitch matching even for normal listeners can also be highly variable. Keep that in mind with tinnitus patients, as well.

So, we've looked at this with relationship to the audiogram to see if the pitch match could be predicted from the hearing loss. And it looked like in general that some people might show a relationship between the audiogram and the hearing loss and the pitch match, but it wasn't very clear for most patients.

We did a follow up study with several hundred patients many years later, and the bottom slides shows that we grouped these patients and their pitch match was low frequency on the left and then middle frequencies in the middle two graphs and then in the bottom again people that had really high pitch tinnitus, they were on the right hand side. Now, the average audiograms are shown in the middle panels and the individual audiograms are shown at the top. So, the point here is that for the typical person, the audiogram itself does not really predict at all what the pitch match frequency is because you can see the audiograms can be very similar, but the pitch match can be very different, the high and low, and there's no clear relationship at least on average between the pitch

match frequency and the audiogram.

So, loudness. So, my background is in psychoacoustics. And one of the things we do is we ask patients to adjust the loudness to assess the loudness of their tinnitus on a scale of 1 to 100. 0 would be a very faint sound. And 100 would be very, very loud. I would like to know the subjective rating of your tinnitus on this scale from 0 to 100.

We can also do loudness matching. So, for example I'm going to present a tone and I want you to adjust the level of my tone so it has the same loudness as your tinnitus. And there are several psychophysical procedures one can use here. But the most important thing I would suggest is that the loudness matching be done in the ipsilateral ear of the tinnitus, the same ear, and using monaural stimuli only.

So, this is a survey done by Jack Vernon and Mary Meikle who measured the loudness matches of patients. And as you can see the sensation level above threshold where that match was done was often only 6 dB above threshold. A lot of patients complained it was so loud, but it was only 6 dB above threshold. Why do they perceive it so loud? dB sensation level is not a measure of loudness, it's the measure of intensity of the sound above threshold. And most of the tinnitus patients have some hearing loss and therefore have loudness recruitment. Therefore something only a few dB above threshold can actually be very loud. This is an audiogram of two different patients. The frequency on the bottom axis and the level on the other axis. And 0 dB hearing level is shown on the bottom with the gray areas. That's dB sound pressure level. And the audiogram of this person is shown in this ear with the circles. Their pitch match frequency is where the arrow is on the right hand side of that left-hand figure. And the square shows the pitch match, the loudness matching at the pitch match frequency. So, in this case, it's only a few dB above threshold. The diamond above that is the loudness discomfort level and we also do work with hyperacusis. But the main point here is for that individual, the loudness of their tinnitus was only a few dB above threshold. But that's when we did it at a high frequency where their pitch match was. If we go to the other end of that lower left figure and we look at the other open box, it's actually 30 dB above threshold. And that's because that person has normal thresholds at that lower frequency and therefore did not have loudness recruitment. So, something above threshold only a few dB would be very, very quiet.

Next slide shows our attempts to measure binaural masking. This was interesting in some of our early experiments in trying to focus on different kinds of masking

procedures so we could measure in the right ear. We put the exact same noise in the left ear so you see the little scribbles as the noise wave form, the same in the right ear and the same left ear. When we put that noise in both ears at the same time, which is the fourth one down, then the noise is heard in the middle. But if we put in a different, uncorrelated noise wave form, that's heard throughout the head. But if it's correlated, if it's the same noise, then for a low frequency noise in particular, you will hear that in the middle of your head. If you use a time delay, if you keep the same wave form, but you delay the wave form of one of those correlated noise sources, you can actually move the perception of the noise around in your head. So, we thought maybe we could actually come up with a noise level that was less, more effective at masking the tinnitus.

So, we were not very successful. I think we tested about 10 patients. But only one patient, the upper right hand patient, subject four, and these are just different conditions where we show the amount of noise required to mask the tinnitus. But we see with the time delayed one on the far right, it was actually 20 dB less noise required to mask the tinnitus for that one subject out of about 11. In any event it was an interesting approach and certainly has some potential for setting maskers with that more sophisticated approach of correlated noise.

So, frequency dependent masking is also kind of interesting. That is that I could ask you to adjust the level of my pulsed tone at a certain frequency until it just masks your tinnitus. So, adjust the level of my tone so it just masks your tinnitus. And I could do that at a variety of frequencies below and above the most prominent pitch of your tinnitus.

Shows the audiogram of four different hypothetical patients. In the upper right hand corner, we see somebody who has their audiogram is with a straight line. The arrow pointing down is where their pitch match frequency is. And for this person, a high sound pressure level that's those squares at the bottom of the audiogram, those are the levels required to mask the tinnitus for that patient. So, it didn't matter what the frequency of the noise of the masker tone was. It required a high level at all of the frequencies. Below that, you will see another patient who had a similar pitch match, but we could not mask the tinnitus in that patient at all, even at the highest levels available. If you now go to the upper left hand screen, you see again the audiogram, the line, and the arrow where the pitch match is. And for that patient, you can mask the patient at a very low level independent of the frequency. This was quite a surprise for me because when you do a similar experiment in normal hearing listeners, and now I want you to look in the

lower left hand box, if you put in a pure tone to people and try and mask that pure tone with another pure tone, when the pure tones are close in frequency, it's easy to mask the first one, the pulse tone. And as you move the masker tone further away in frequencies, it makes it more difficult to mask that pure tone. And that's because the masking occurs, at least for pure tones on the basilar membrane inside of the cochlea. We thought that people had a tinnitus masking pattern in the lower right hand corner, that would indicate that it originated on the basilar membrane. It turns out most people don't have that. A few do, but most do not. And you can see the wide variety of examples we showed in terms of trying to mask patients' tinnitus with pure tones. So, it's important, not just in measurements, but also in counseling that we're all different. And certainly the tinnitus can be quite different in different people.

Okay. So, the next thing I want to show you is post masking effects, sometimes referred to as residual inhibition. In this case, we presented a noise that masks the tinnitus for 60 seconds. We presented that noise 10 dB above the tinnitus. And then we quantified the loudness of that tinnitus before and after we had our masker on.

The top slide shows the tinnitus loudness in the dash line and the masker in that box. And we turn the masker on and the person doesn't hear their tinnitus anymore. And we turn the masker off and the tinnitus comes back to the exact same level. In example B, we turn the masker off and the tinnitus is there right away, but it's at a lower level. In example C, the tinnitus is gone completely. So, the person is listening to a masking sound, we turn the masking sound off and the tinnitus is gone. And I recall doing this experiment in England where my first job was. And I had a 31 year old man in the sound proof booth going through this, these experiments, and he came out of the booth crying. And he came out of the booth crying because this was the first time as he told me, this was the first time in 10 years he had not heard his tinnitus. That was quite moving for me. So, in D, the tinnitus is gone when the masker is turned off and then comes back on abruptly. And in E, which does not happen very often, but is important in terms of considering using masking strategies for treatments, you can see in E when the masker noise was turned off, the tinnitus was much worse. Unfortunately, it did return to its pre-masker level. So, different subgroups, different types of tinnitus patients here would likely be relevant to treatments, as well.

So, we've talked so far about measuring the tinnitus itself and now I want to focus on measuring the reactions to the tinnitus. So, we started off, one of my first experiments in England was an open ended questionnaire. So, instead of thinking I know all the

correct questions to ask, we use this. Please make the list of the difficulties that you have as a result of your tinnitus. This is good for patients in the waiting room or at home before they come into the clinic. We want to know what will you think is important, what difficulties are you having because of your tinnitus? So, we ask them to list them in order of importance and we use these to understand where the patient is at. Clinically with our tinnitus activities treatment, we want to know where the patient is at. It's not that I'm the clever clinician, I want to sit back and learn from where the patient is at and where their needs are and how their tinnitus is affecting their life. This open ended question is often an important place to start. We then developed the questionnaire for clinical trials, referred to as the tinnitus handicap questionnaire. That has been translated worldwide. There are 27 items, scored 0-100. And it has been used in several trials around the world actually in treating tinnitus. That's one that we sometimes use, the tinnitus handicap questionnaire.

A more recent questionnaire is the tinnitus functional index. I actually do not like this questionnaire because it has a few questions that are general like, "Do you feel in control in regard to your tinnitus?" Or some quality of life questions like, "How much does your tinnitus interfere with your enjoyment of activities or your relationships with family, friends, and people?" And it's certainly true that tinnitus can do that, but the problem is with this questionnaire that if people are having trouble at work or having trouble with their family or their partner, then they might answer some of these questions in a negative way, not because of their tinnitus, but because of other issues going on in their life. So, I think the Tinnitus Functional Index is not a good questionnaire.

The one that we use is based on our model of tinnitus. So, the functions affected are thoughts and emotions, hearing, sleep, and concentration. And this comes out in a World Health Organization model, as well. And then depending upon how that individual is affected in these four different areas, and again, some people have no difficulty sleeping. Some people have difficulty concentrating. They have difficulty reading a book or focusing on a hobby because of their tinnitus. And these different functions that are impaired have impacts on their activities of daily life including socialization and what they're doing at work and their economic situation. So, tinnitus is really, really important in lots of different ways and it's really important to appreciate the different ways that people are affected, particularly these four functions. So, that led us to develop the Tinnitus Primary Function Questionnaire. This has been translated and is used worldwide in clinical trials. Some examples of these are I have difficulty focusing

my attention on some important tasks because of my tinnitus. My emotional peace is one of the worst effects of my tinnitus. In addition to my hearing loss, my tinnitus interferes with my understanding of speech. I lie awake at night because of my tinnitus. So, those are some examples. There's a 16 item questionnaire and a 24 item questionnaire, which has been translated in many different countries and is used worldwide in clinical trials and in clinics.

So, this is some work that we did with our tinnitus activities treatment where we used the counseling in these four different areas, depending on the area that's affected. And this was just a slide showing that we can help people with our counseling and the responses that people get from their tinnitus. Remember in the very first slide we might not be able to change the tinnitus itself, but we can help patients change the reactions. And these are the four different reactions that they experience.

So, for the questionnaires, just as a review, the open ended questionnaire is very helpful clinically just to listen to the patient and let them focus on what is important for them. That's really helpful. It's important as a clinician to be a good listener. And this creates some formal way of letting the patient share what is important for them. We use the tinnitus primary questionnaire to plan our treatment. So, almost all patients get thoughts and emotions and hearing conservations including hearing aids and sound therapies in our tinnitus activities treatment. But if someone doesn't have problems concentrating or problems sleeping, we can ignore those modules in our counseling. For clinical trials, it's important because this is a sensitive tool. Each question is scored from 0 100 and we published some interesting work as have others focusing on clinical trials using this tinnitus primary functions questionnaire.

So, in summary, there are some very important benefits to measuring tinnitus. And the first one is just improving your communication with the patient. So, as I said, some patients are surprised. You mean you can measure this? And that connects with them and shows them that you understand tinnitus and that their problems are real and we understand that. We can provide reassurance by showing them that they're not alone, that lots of people have problems, and these are the common problems. So, they have real tinnitus. It's a real sound that they hear. We can measure it and we can do pitch matching. We can do loudness matching. We can quantify it and show the patient that it's real. They're not making this up. Categorize the tinnitus. So, for some patients, as I said, the tinnitus gets worse after noise. For some patients, it gets better. For some patients you can mask it with pure tones. For some patients, you can't mask it at all.

So, developing a pill and developing a surgery for tinnitus is only going to work if we subcategorize tinnitus patients. They're all different. One pill is not going to help everybody. We're going to have to find different subgroups of tinnitus, different categories of tinnitus, and try and determine if that pill can help that particular subgroup or particular category of tinnitus, likely based on the measurements that I've described here today.

Fourthly, the measurements can be used as a baseline for treatment and subsequent assessments. So, we want to know if the patient is feeling better. We want to know if they're feeling better or not in what particular area. If they're having trouble sleeping even after our counseling, we'd like to know that. Maybe we need to try something else. Maybe a sleep medication is okay in the short term. We want to follow our treatments and their effectiveness and what areas are effective and what areas are not effective. So, that's important. The selection of treatments is helpful. As I said, we can use the tinnitus primary function questionnaire to decide whether people want or need counseling in terms of the sleep or need counseling in terms of the concentration or not. Most people benefit from thoughts and emotions and from hearing counseling. And from being able to show the patient that we can mask their tinnitus is helpful in fitting sound therapy devices. We want to know what their tinnitus is going to be like when they take the sound therapy device off at bedtime. And as I also mentioned, there are some sound therapy treatments that depend on the pitch match frequency of the tinnitus. So, in that case, the measurements are an essential tool in designing that particular treatment strategy. And then finally, it's important to document tinnitus. As opposed to just someone saying they have it, it's important to be able to document it and to show that it's real. And for some people, in both legal cases and in work related composition or in getting time off from work or teaching, having some documentation that it's real and can be measured helps that patient in their daily life activities. Okay.

>> ANIL LALWANI: That was terrific. Very clear. I especially enjoyed that figure about pitch matching, but hearing test looks very similar across. I had not seen that before. That's an interesting finding. Sort of unexpected in some ways. There's a lot of questions, Dr. Tyler, about treatment for tinnitus. And I thought maybe you could broadly take the question. Do you see any new promising treatments on the horizon? What's got your attention at this time?

>> RICHARD TYLER: Well, I am going to say there's lots of interest in tinnitus now because so many people have it and because there is no pill and because there is no

surgery. So, I think that one of the good things is that there are lots of people and companies exploring this. And they're exploring it not just on tinnitus patients at large, but they're using measurements, some of the measurements we described to focus on a subgroup. So, you know, for example if you cannot mask your tinnitus, maybe it shouldn't be, you're unlikely to do well on a particular drug. There are some drugs that are being explored for patients who have only had tinnitus for six months or less. There is different vagal nerve stimulation that has become popular. I don't want to say there is anything on the horizon, in my opinion, that is clearly going to work. But I think it is very exciting and potentially valuable that there are so many groups now interested in this and that there are so many groups now paying attention to the measurements that we discussed today as trying to identify different subgroups. Because identifying different subgroups is going to be critical in my opinion in finding those cures. And I say that in plural.

>> ANIL LALWANI: Rachel asked how counseling of tinnitus patients would differ depending if the patient has residual inhibition. How do you incorporate that into the treatments and so on?

>> RICHARD TYLER: The aspect of residual inhibition would come into play mostly when we're talking about sound therapy devices. I have seen, so, how long you keep the device on for, for example, and at what level you keep the device, you set the masker at. I've certainly seen more than one patient who has noticed that their tinnitus goes away after they leave a noise on for several hours and their tinnitus can be gone for several hours. So, that doesn't happen very often, but I've certainly heard that once or twice in some patients that are very clear effects of this. So, I think that, you know, paying attention to what happens after you take the masker off, whether it gets worse or it gets better is an important ingredient in trying to coach the patient before they leave the clinic with their masker. Because again, a lot of patients just want a pill and they're willing to try a masker, but they're not quite sure what's going to happen and providing some guidance on what they might experience when they go home and listen to a low level masker sound all day long. It's important to discuss what the options might be with them before they leave the clinic.

>> ANIL LALWANI: There's several questions related to the sound in the tinnitus itself. Whether it's a single tone, multiple tones, overlapping tones and so on. What does that tell you? When somebody describes a complex versus maybe a simple tinnitus in terms of the sound quality? Its impact on diagnosis and treatment?

>> RICHARD TYLER: Right. I guess I would say that if it sounds like a pure tone, then the implication for that is that it's likely affecting only one part of the auditory system. Because of course when we play a pure tone we are stimulating only one part of the basilar membrane and all the nerves up in the auditory cortex. If somebody hears a broad band sound, then that may mean there's a lot more parts of the brain affected. I'm not sure if it necessarily dictates the strategy for masking or counseling per se. Certainly it would be more difficult for somebody listening to a pure tone in general than it would be a broad band whooshing noise. But it's difficult to know exactly where that's going at this point and what the different implications would be for the mechanisms involved.

>> ANIL LALWANI: Gotcha. And somebody asked earlier about what a pure tone was. It's just a simple single frequency.

>> RICHARD TYLER: Right. Pure tone is a single frequency. Broadly speaking, if you hit a single piano key.

>> ANIL LALWANI: Gotcha. You discussed the importance of assigning an individual to specific subgroups. Being able to identify some characteristics. Do you have any sense of when we'll identify an instrument to do this or is there an instrument that does that for you in some way?

>> RICHARD TYLER: We published an article on this many years ago using a statistical analysis. But the bottom line here is these various measurements that I shared today. If you could take 500 patients and give them all the measurements that I showed you today, you would see, you know, 50 patients do this and 50 patients do that and 100 patients their tinnitus is not affected by noise. And 50 patients, they have very long post masking effects where things disappear to 0. So, it is based on these measurements themselves that I think would be the starting point of focusing on. So, you could give pills to 1,000 people, but instead of analyzing the data based on group averages, which I've criticized for many years, you could determine how effective that pill was for people who had a tonal tinnitus or people with tinnitus who you could mask at a low level. Or how effective was that pill for tinnitus patients who you couldn't mask at all or who had a frequency tuning curve. You could analyze the data based on the particular subgroup of patients it falls into. I think that's the goal in finding a cure or cures I should say plural because it's going to depend, I think, on the different mechanisms involved and a

particular insight on that is how we measure it. And we have to start analyzing the data based on these kind of subtype measurements.

>> ANIL LALWANI: There's lots of questions about cochlear implants and tinnitus. Do you want to address in any way you can whether they can help tinnitus? Or what are your thoughts about those two things together?

>> RICHARD TYLER: Right. I'm glad to get that question, because actually I've been working with a group in Europe to try and promote this because for a lot of patients they get a cochlear implant and they say oh thanks, I can hear better now. But even better than that, my tinnitus is gone. Now this doesn't happen for everybody. For a very small number the tinnitus gets worse. But for most patients, they actually help with their tinnitus when they get a cochlear implant. We can use sound therapy just like we use with hearing aids, processed through the cochlear implant. And it's pretty encouraging even in many countries in Europe when you have a unilateral deafness, deafness in one ear. Many patients actually get a cochlear implant for that ear, even though they still have pretty good hearing in the other ear. And they're getting a cochlear implant not because of their hearing loss in that ear, but they're getting a cochlear implant because it helps them with their tinnitus. And so fortunately, a lot of the cochlear implant companies are realizing this and getting more involved in trying to document it and hopefully more involved in changing the rules and regulations in the United States for who qualifies for a cochlear implant or not. So, I'm really excited about the potential for cochlear implants to help tinnitus patients.

>> ANIL LALWANI: And I think some people have actually shown that for unilateral deafness, those patients that have tinnitus, as well, are actually happier with a cochlear implant than those without.

>> RICHARD TYLER: Absolutely.

>> ANIL LALWANI: I know this is going to be a hot topic. I wonder if you have any thoughts about COVID and tinnitus? COVID vaccination and tinnitus? Some people out there believe they're getting their tinnitus after a COVID vaccination. Any thoughts or data you have?

>> RICHARD TYLER: The main factor here is the very first slide I showed showing the tinnitus versus the reactions to the tinnitus. The reactions you have from your tinnitus

depend upon your psychological makeup and what status you're in and what kind of challenges you have in your life right now. If you had tinnitus for five years or five months and you don't like it, you're doing the best you can, and you wish it wasn't there, and then all of a sudden you get COVID, the COVID doesn't have to affect your tinnitus. And I'm not sure that there is any evidence that it does affect the tinnitus. But in that psychological model I proposed, if you're stressed out about life because of COVID, that's going to put you in a much worse condition to deal with your tinnitus and you're not going to be as able to deal with that tinnitus that you had before the COVID. So, I have not seen any data at all showing that the COVID treatments cause tinnitus. But I do know people that have COVID and already have tinnitus, their tinnitus can be more problematic because now their life is even more complicated than it was beforehand. So, that's my take on it.

>> ANIL LALWANI: Gotcha. There's some questions about hearing aids and their effectiveness in people that have tinnitus as well as how does masking work for people who otherwise need hearing aids, as well?

>> RICHARD TYLER: Right. So, hearing aids are actually wonderful things and I just published a new meaning of life article. I developed a questionnaire. I don't like any of the quality of life articles. I don't think they're valid. So, we developed a new quality of life questionnaire, we call it the meaning of life. We administered that to cochlear implant patients and tinnitus patients. It emphasizes it's not about hearing. It's about communicating with people and socializing and having friends and looking forward to the future. That's what hearing is about. Independent of tinnitus, we should all take care of our hearing. And I often say to the patients I hear as well as I did five years ago and five years ago I think I heard as well as I did five years before that. But we're all getting a hearing loss as part of the natural aging process. And so hearing aids are really, really important. And when we're hearing better and communicating better and enjoying life better, we're going to be in a better position to deal with our tinnitus, whether it's been there before or whether it just starts. And the same can be said about the sound therapy devices, the maskers. They have to be fit appropriately and they don't work for everybody. But they can help for a lot of patients with tinnitus, having some background sound can be very helpful in reducing the magnitude of the tinnitus or reducing the loudness. And it works for a lot of people. There's usually a trial period and the sound therapy for the maskers and the hearing aids are another great way that we can help our tinnitus patients.

>> ANIL LALWANI: I'm curious when you see a patient with tinnitus, is the fact that they have hearing loss or don't have hearing loss make a difference to what your first steps are in their therapy? Would you go to hearing aids first or antidepressants to people who don't? What's your general thoughts about your approach to the patient? And by the way, a related question, because you're so clear in your description, how do you describe the physiology of tinnitus to your patients? Maybe if you can describe those two things together?

>> RICHARD TYLER: I describe the physiology of the tinnitus to the patients by saying there's lots of random activities. We have some slides we show our patients in our tinnitus activities treatment. We show the nerve fiber activity even without sound in a normal ear as spontaneous activity on that. And your brain, our brain is used to that and ignores it. So, whatever your cause of tinnitus, whether it's noise exposure or medication or aging, somewhere in the auditory system, that spontaneous activity has increased and your brain does what it's supposed to do. It interprets that spontaneous activity as a sound. Your brain is doing what it's supposed to do. It's interpreting that extra spontaneous activity as a sound. I'm sorry. Can you remind me the first part of the question?

>> ANIL LALWANI: When you start thinking about treatment, divergent pathways. Is one of them hearing loss or no hearing loss?

>> RICHARD TYLER: Okay, right. So, when the patient comes in, we almost always just start with their audiogram. We want them to show us their audiogram and what they think about it and I go over how important hearing is. And again, they almost all have a hearing loss and again some people's hearing thresholds were minor 10 dB at age 19. And if their thresholds are now 5 dB, they have a hearing loss. So, it helps the patient to confirm that they might have a hearing loss and we can show that on the audiogram so we're not making this up. So, it's pretty clear, again, emphasizing how important it is to hear that providing hearing aids amplifies sound and that helps us deal with life and interact and socialize and that's going to put us in a better position when we're hearing and communicating. It's going to put us in a better position to deal with life's challenges. And one of life's challenges is the tinnitus. But if we can hear and communicate with hearing aids that are going to improve that, then we're going to be in a better position to deal with tinnitus. And the same thing with maskers. As I said, we often tell the patients right away that well, you've got a bit of a hearing loss here and hearing aids are going to help you hear better. They need to be fit properly. And also

there are a lot of patients that try background sound. And for a lot of patients, they listen to the background sound and it reduces the loudness and reduces the prominence of their tinnitus. I tell them it doesn't work for everybody, but there's a trial period and it works for a lot of people. And so we try and get them started on not just the tinnitus activities treatment counseling, but also based on hearing aids and sound therapy, at least being aware that there are options.

>> ANIL LALWANI: Well, I should have told everybody in the audience that was probably going to be our last question. But maybe one last quick question. Any foods I should avoid or people should avoid that have ringing? Do you hear anything about that?

>> RICHARD TYLER: Right. I get asked about this all the time. There's surveys that show that there's a higher incidence of tinnitus if you drink a lot of coffee. But there's also some surveys if you drink a lot of coffee there's less likelihood that you'll get tinnitus. What I tell patients is whether it's coffee or whether it's a pill or even a medication that's prescribed by your physician, do an experiment on yourself. And I use coffee as the example. If you think coffee is a factor, then stop drinking coffee for three weeks and don't change anything else in your life. Stop drinking coffee for three weeks, don't change anything else in your life, and see what happens. And that could be a pill. You could do an experiment on yourself, even if it's a dietary supplement. I've even told patients have your partner buy two different kinds of pills. One that is supposed to help with tinnitus and one that's not, and do a double blind cross over experiment on yourself where your partner is controlling what pill you get. But you can certainly talk with your physician if you're thinking a prescription is causing your tinnitus, which it might be. Including something like an antibiotic, whatever it is, you can talk to your physician and say can we change the dosage and decrease that for three weeks or try a different pill for three weeks, don't change anything else in your life, and see how that affects your tinnitus.

>> ANIL LALWANI: Dr. Tyler, thank you so much for your informative research presentation. I especially want to thank our audience for joining us today and participating in our seminar. Look out for the next issue of Hearing Health Magazine premiering this week themed Tinnitus and Hyperacusis to learn even more tinnitus management techniques. Remember presentations like these and research projects like Dr. Tyler talked about this afternoon are only made possible by supporters like you. You can donate at hhf.org/donate. And again, thank you and have a wonderful evening. Dr. Tyler, again, thank you.

>> RICHARD TYLER: Thank you. All the best.