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Hearing Aid Fitting Parameters for Management of Chronic Bothersome Tinnitus

Presenter: Brian J. Fligor, PhD, PASC

It's my pleasure to welcome back to Audiology online a friend of ours, Dr. Brian Fligor. Today, Dr. Fligor will discuss hearing aid parameters for management of chronic bothersome tinnitus. And at this time, I'll hand the mic over to you.

Fantastic. Thank you so much. Thanks, everybody, for joining. This is just one of my favorite conversations to have with folks specifically and anything and everything related to tinnitus, tinnitus evaluation, tinnitus therapies, tinnitus management. And so this is a very specific topic here today is talking about hearing aid fitting parameters.

So really getting down into the weeds of how hearing aids, how, how the. How one would approach a fitting strategy for people with chronic bothersome tinnitus and the fact that we can't really address their tinnitus issues through a first fit much of the time. So first fit parameters can be really effective at helping a person who's never used hearing aids before and are needing to use hearing aids for the sake of being able to, you know, hear and understand people who are talking with them. That's great for hearing management, hearing loss management, but for tinnitus management, it is different. And I think that sometimes that can be a little bit challenging for those of us.

So without further ado, let me just jump right in and give a little bit here. So I have my disclosures listed out. You all are welcome to go take a look at that. The content that I am going to talk about today is informed by work that I've done, but I don't specifically endorse any particular products or manufacturers. Limitations and risks of participating in today's lecture.

Please take a look at it and evaluate and consider for yourselves. And then here are three specific learning outcomes that if one were to say, well, what should you be able to do when you finish, you know, participating in today's presentation? These three pieces are what's important. Okay, so let's hop right into it. I'm going to talk a bit about kind of, well, okay, how many people have tinnitus and how much of it is bothersome.

You know, I think that we hear these numbers a bit, but it's important for us to set the stage. I think it's important for those of us who have tinnitus to feel validated that others can appreciate and understand what it is that's going on in our ears, but as well to have some understanding and appreciation for how sound enhancement, specifically using masking, can be a valuable tool. It's a tool, it's not a fix. There's reasons why it can't be be very helpful, and some reasons why it ends up not being helpful at all. I want to talk today about that evaluation process for people with tinnitus and also with sound sensitivity disorder, or what we think of as hyperacoustis.

So sound sensitivity disorders go hand in hand with chronic bothersome tinnitus. There's lots of overlap with it. There's a spectrum of the severity of both. We're going to talk very specifically identifying the technology features in hearing aids, as well as how we're going to then apply masking and amplification when amplification is actually needed. I'm going to review some illustrative cases, and we'll summarize.

So, thinking first, before we talk about epidemiology, I want us to really dissect how people experience tinnitus. Okay? You know, we understand tinnitus to be this phantom noise, you know, the sound that's in our ears, in our head. It could be in one ear, could be in both ears. The way a person experiences their tinnitus is not based on just what's happening with their hearing or just what's happening with their brain or the part of the brain that does hearing.

It has to do literally with three different independent but interconnected areas of the brain. When you have bothersome tinnitus, all three areas of the brain are engaged in some capacity. So what I mean by this is we have this plate or like a board. I think of it like, kind of like your charcuterie board of tinnitus. Okay?

It's this board that you have sitting out. It's. It's the size of it and how much it's holding that dictates what your experience of tinnitus is. The larger your board, the more support that it needs from the different

brain areas, but also the more severe your experience with that tinnitus. And if any one of these supports, okay, like these legs of the table, if you will, each one of these supports, if it's not holding up its end, then the plate falls over and you have less tinnitus.

So any one of these supports here is basically it's. It is an area that is amenable to us providing an intervention. Well, in the part of our brain that does hearing, our auditory cortex, this is where we actually hear the tinnitus. This is our perception of this sensation. But the perception of it, whether it's bothersome or not bothersome, is not dictated by the cortex.

It's actually dictated by the limbic system that's where we would react to that chronic, bothersome tinnitus. It's not bothersome if the limbic system is not being activated by the perception of the tinnitus. Okay, well, if our limbic system is being activated by the tinnitus, this. Then if it's severe enough, if it's reached this level of not just a little bit of annoyance, but more like a, oh, my gosh, this is a problem. This is a threat.

This is a wow. This is something that is a problem to be solved, and we need to think about it and explore it and understand it. If the limbic system, the part of the brain that dictates our primal emotions like anger or fear, dread, lust, a certain appetite control. If our limbic system is really activated by the perception of this sensation, then it's informing the tension center of the brain, the thalamus. It's informing it, hey, that sensation that we're getting from the auditory cortex, that is a problem.

That's something that we've got to figure out a way to solve it. And so the thalamus gives focus and attention to that. Now we have some conscious control over what we're paying attention to. I mean, thank goodness, hopefully, your thalamus is heavily engaged in looking at the slide that I'm presenting to you and hearing the instruction that I'm giving, the verbal instruction. So hopefully your thalamus is actively engaged on that.

But those of us who have some attention deficit challenges, our thalamus is very easily pulled off in other directions. You know, the goodness. The movie up and the dog gets distracted by the squirrel. Just yells squirrel all the time. Well, imagine if your squirrel is tinnitus, that you're trying to pay attention and focus, and the next thing you know, your thalamus can't help but reflexively get pulled back over onto your tinnitus.

And so you're always trying to engage your attention on other things that are not your tinnitus. But you can never just chill and relax because the moment that you do and your thalamus is not actively being engaged by you. Your higher level thinking, it reflexively goes back to the reaction your limbic system is having and attending to that. Well, when that happens, when your thalamus is reflexively going to it, it is saying, hey, this sensation that's a threat that the limbic system has said is a threat, it is now informing the auditory cortex. It's kind of feeding back over into the auditory cortex, saying, that sensation that the limbic system doesn't like make sure.

I never lose sight of that. Okay, make sure. Well, sight or hearing that let me make sure that I'm always aware. And so what the auditory cortex does is down regulates some neurons that are responsible for attenuating our experience of sensations, all of our cortices. So our.

Our visual cortex, the part of our brain that sees things. Okay, it's back in the back of our brain. It's our occipital cortex, our somatosensory cortex, the part of our brain that feels things actually, you know, like touching something. Like the part of your brain that responds is your somatosensory cortex. Well, if you wear a watch, the watch on your wrist is sending a signal while the.

The nerves under your skin there are sending a signal to the somatosensory cortex. And it's saying, you've got a watch, you're wearing a watch, you're wearing a watch, you're wearing, like, literally constantly. Signal is being sent up to the somatosensory cortex, saying, you're wearing a watch. Well, after you've had that watch on for a little bit, you habituate to that sensation. You forget that it's on.

It doesn't mean that it's not on your wrist still, but you forget that it's there. You literally habituate to that sensation. You just don't even feel it anymore. The way habituation happens, the way that it works is there's this network of inhibitory neurons. When they turn on, they turn off an excitatory neuron.

So the neuron that turns on in response to the sensation that that nerve signal coming from your wrist up to your brain, those are the excitatory neurons they're turning on. And as they do, and as the whole system comes to appreciate that this really is not consequential to know that I still have a watch on my wrist. What it means now is, oh, okay, I. I don't need to be aware of that anymore. I don't need to physically observe that sensation.

So the inhibitory neurons tamp down the action of the excitatory neuron. Yay. So that's really helpful, and that's nice to have, because otherwise we'd be highly distracted by the sensation of that watch on our wrist. Well, when the thalamus reflexively gets pulled onto the awareness of your tinnitus, what it's doing is it's telling the auditory cortex don't allow those inhibitory neurons to tamp down the action of the excitatory neurons. Those excitatory neurons that are firing in response to that circuit noise.

That is the tinnitus. Those excitatory neurons are basically just going and going and going and going. And the inhibitory neurons are being told don't activate because the thalamus says you need to not habituate this sensation. And so what happens is then your excitatory neurons, there's an imbalance between how active they are because your inhibitory neurons have been down regulated, so you have more action of the excitatory neurons, which causes the tinnitus to sound louder, which causes you to have a stronger reaction, which makes the thalamus more aware of the tinnitus. It's doing exactly what it said it wanted.

Well, that causes your auditory cortex to further downregulate your inhibitory neurons. Therefore the tinnitus gets louder so you react to it more strongly. So pay attention to it more. And you see that we've

got this spiral, this loop basically starting to resonate. Well, that's all just a bad, bad scenario.

How many people have this? Well, estimated 10 to 15% of the US population has tinnitus. Study published in 2022, very nice study indicated that the prevalence of tinnitus is about 14.1% in the US population. And the percent of people with tinnitus increases as you age. Well, co occurring with hearing loss.

The more hearing loss there is, the more likely you are to also have tinnitus. It's not one for one. There are people who have hearing loss without tinnitus and there are people who have tinnitus without hearing loss. It's not exactly straight that way. They are not the same injury or the same disorder.

Hearing loss and tinnitus are separate disorders. That said, they do co occur. We understand that somewhere around 6% of the US population has tinnitus bothersome tinnitus. So 50 million people have tinnitus and 20 million of them are bothered by it. That 30 million who have tinnitus.

The 30 million who have tinnitus but are not bothered by it, there's activation in the auditory cortex, but there's essentially no activation in the limbic system. Okay, so 30 million people, well, 50 million people have tinnitus. There's activation of this sensation in their auditory cortex and 20 million of them have a threat response by the limbic system. That's the difference. Now of those with that threat response, about 10% of them, so 0.6% of the US population, or about 2 million people have what we would be, what we would refer to as debilitating tenderness.

And we're going to describe what we mean by debilitating. You know, so it's the severity of it. It's up in the severe or catastrophic level.

Okay. Oh, yeah, I actually talked about that. So without my slide. So 30 million people just noting that the limbic system doesn't have activation that 20 million they do. And what happens here in those that

have debilitating tinnitus, it's that there's this reflexive priority that the thalamus has given, resulting in that downregulation of those inhibitory neurons, causing your tinnitus to be louder.

Okay. It's not just sensorineural hearing loss that's associated with tinnitus. If you have an ear infection, you have middle ear effusion. If you have a plug of earwax, you may observe your tinnitus that's already there. It's just more present to you because of loss of external sound.

It is associated with increased sound sensitivity, as I referred at the very beginning. Condition known as hyperacusis. Sound that is loud but tolerable to others is painfully loud to the person with hyperacusis. Chronic bothersome tinnitus is significantly associated with anxiety, with depression, and with negative repetitive thoughts. Kind of what we think of as these intrusive thoughts that has some components of obsessive compulsive behavior where there's a thought that enters in and it's negative and it's bringing down your mood, and you reflexively are coming back to that, and you can't eliminate it.

You can't get rid of it. Tinnitus, though, is typically not associated with dizziness. If you do have some condition that's causing activation of your vestibular system, such as Meniere's disease, well, you could have tinnitus, and you could have tinnitus and dizziness. If you have a viral labyrinthitis, for instance, where one side you've got this, you know, you know, a vertiginous attack that's, you know, viral or idiopathic, you could also have tinnitus in those instances. But those are the exceptions to the rule.

The vast majority of people who have chronic bothersome tinnitus, so that 20 million in the United States are not also dizzy.

So I. I would expect most of you out there have had experience of tinnitus either going to a loud event or, you know, having an ear infection or perhaps you've, you know, just developed tinnitus over time, as lots and lots of people do. But people describe their tinnitus in varying different ways. It is most common for us to hear people say that I've got this high pitched tone in my ear or we think of ringing in

the ears. Specifically those of you who don't really want to hear this because it might trigger your own tinnitus.

Just note that I'm going to play some for probably about, about 10 seconds. It's just this higher pitched. It's actually a roughly 4500 Hz tone. Okay, I'll stop talking so that you could mute if you need because you don't want to hear this.

Okay. Now some people describe their tinnitus as more of a hiss that's more along this kind of quality.

And other people describe their tinnitus as more of a buzz.

One of my former students, a gentleman named Frank Wordinger, who's an audiologist in the Philadelphia area, he specifically works with musicians as well as in hearing conservation work. Frank is an audio engineer by background and training and he, he has tinnitus from playing in rock bands when he was a teenager and then on through and he sample. Well, he, he basically hitch matched and loudest matched the tinnitus that he hears 24 7. And he gave me copy of that file and he said, here you go. So this is a little bit longer.

I'm going to play only about 10 seconds of it.

So his is multi tonal. It's got a little bit of a low pitched roar or hum to it. It's got a higher pitch tone and it's got a hiss going on in there. So when we look at loudness matching, we might be able to match the loudness of it. If we look at trying to match the pitch.

Well, that can be pretty hard to do for somebody who's not an audio engineer or an audiologist who sits and listens, you know, all day, every day to stuff. Perhaps a musician would be able to as well. I'm going to suggest that it may in fact not be terribly important for us to do more than document the

person's reporting of the symptom of their tinnitus. Like what is the quality of it? The fact that there is a phantom noise in their ears.

What it is a ring, a buzz, a hiss. If it's bothersome, that's what matters. Areas in which it's bothersome, that's more important to me. Is it interfering with your sleep? Is it something where you just feel like you can't escape from it or it actually makes you feel claustrophobic, like they've just, just lost control?

Is it triggering an underlying anxiety or depression? Or is it actually Resulting in having anxiety and depression, inability to relax, difficulty with concentration. These are all things that are causing people to be well bothered by their tinnitus. Well, one of the cornerstones of tinnitus management is that we provide people with a sense of control whether or not the tinnitus is actually masked. That's a tough one because tinnitus itself is not masked.

The way we would provide masking, say for con. For doing bone conduction testing or, you know, you know, say somebody has a fairly significant asymmetry between their ears, and you have to provide contralateral masking for testing. What we're doing in those instances where we're playing a narrow band noise to shift the audibility of a test tone, that's done energetically. Okay, meaning, so if I'm presenting a 40db hl 1000hz pure tone and I don't want the other ear to hear it, well, I'm going to present a narrowband noise. So it's about one third octave wide narrowband noise.

That's roughly about 40 decibels or more. And that's going to shift the other ear's ability to perceive my test signal. Well, that test signal is external. That's actual energy that's being delivered acoustically through the ear. Okay.

Tinnitus is not an external sound. It is activation of neurons, perhaps in the periphery, you know, the first order auditory neurons. Perhaps it's partly up the brain stem, perhaps it's in the auditory cortex itself, and that's where it's existing. And we don't even have activation below. And so in order to kind of

wash out the activity of that tinnitus, that neural activity that is the tinnitus, we'd have to engage neurons around that same area.

And it doesn't necessarily work like that. So when we're masking something, that masking is done more informationally, as in the. What we think of like central masking, not peripheral masking. So it's informational masking it's attention, it's giving the thalamus something else that is taking priority. And so in essence, what we need to do, if we're providing a masker, that masker should be vaguely pleasant and it should be easy for the individual to ignore.

As in, easy to ignore, as in habituate to it. Like, I just, I forget that that sounds there. Kind of like your refrigerator hum. You know, if your refrigerator's unplugged or the power goes out or something, there's like, oh, wow, my refrigerator stopped the hum. But you Literally don't have conscious awareness of it because its significance is, well, none.

And so the thalamus is not focusing its attention on that. That's what we want. We want a masker that is vaguely pleasant and easy to ignore. So if this is my tinnitus, I should also want to have a masker that's playing.

I can tell you in my ears that masker does not shift my attention of my tinnitus whatsoever. It's there. I don't find it particularly pleasant. It's not particularly unpleasant. I wouldn't call that masker more annoying than my tinnitus.

However, just a regular broadband noise does nothing for me in that instance. Okay, so what do we do? Well, let's assess the patient, let's do our full workup. But there's really important things around what this workup entails. When a person has tinnitus, something's going on, okay?

It may be subclinical amounts of hearing loss. They may have lost some outer hair cells that can't be picked up on pure tone audiometry. That doesn't mean that there's not a problem there. It just means that our test is not sensitive enough to do it. That said, people present with tinnitus and they do happen to have an acoustic neuroma, we need to know people do present with noise induced hearing loss that they may not know that they have a noise induced hearing loss.

People present after having had a concussion, you know, an airbag goes off. We need to know if they what their hearing status is. So we're conducting comprehensive audiometry, pure tone, air bone speech. I'm a big fan of doing quicksand as well on this, just to better characterize what their function is and if they have particular difficulty picking out signal among background noise, especially other talkers where there's some informational masking co occurring. I am a big fan of doing DPOAEs, especially in noise exposed populations, because tinnitus can be a precursor to eventual shift in the pure tone audiogram.

A very good study by Bishop and Grice, I think it was around 2014, showed that tinnitus typically started prior in noise exposed persons. Tinnitus was kind of a canary in the coal mine before the pure tone audiogram then changed as their sound exposures continued. So DPOAEs can be more sensitive to early cochlear damage than the pure tone audiogram is. And I like to do as many frequencies as you can, you know, like four frequencies per octave, doing 1,000 hertz to 10,000 hertz is a very appropriate protocol. I do Generally just use a 65db 55db L1 L2 protocol.

I don't do multiple levels of DPOAEs. I've not found that to be particularly additionally helpful. But definitely doing DPOAEs. Now measuring upper limits of comfort or loudness discomfort levels. This is highly dependent on the instructions that you provide to the individual.

I like to give the person a button so like their response button. But I say I'm going to play a tone and I actually don't. I don't do a pulsed pure tone as I do in comprehensive audiometry. I do. I do a

continuous tone about a second long, maybe a second and a half long and I present to them a level that is quite audible but comfortable, about the same level as a voice, maybe 65 or 70 decibels and I will go up in five decibel steps.

Okay, I'll go up in five decibel steps and say your job is to stop me before I present a sound that you'll find uncomfortable. So I don't want to present a sound that you find uncomfortable or even painful. So let me keep playing the sounds. So I'll play 65, play 70, 75, 80 and then their job is to stop and I do it twice on this. And generally you'll find that people will allow you to present a level that's at their upper limit of comfort.

And I mark their UCL OR LDL is 5 decibels above and I apologize. I didn't realize I had a question. Someone popped up. How common is it for an individual to have multi sound tinnitus versus a single tone? Let me save that one for the end.

I'll come circle right back around to this but thank you for asking that. Apologies guys. I had my Q and A window open but I was like a little. My thalamus was a little too engaged on my slide itself. So anyway, Idls ucls highly instruction dependent.

I of course do tempinometry. However when I do by temps be careful not to automatically do acoustic reflex thresholds. If a person presents with sound sensitivity disorder, don't just do screening 1kHz without any warning to that. It is a really good way for a person to stop the appointment. If you are going to do acoustic reflex thresholds and they are very helpful to do, you do first need to establish trust help that person to understand.

Sometimes we're going to figure out. In order to figure out what's wrong we're going to have to kind of poke at this just a little bit. I'm going to do it very gently. We'll talk about it in advance. But just like if you go to your primary care doctor after you sprain your ankle, they're going to squeeze different areas to

see where it hurts.

That's called palpating. So they palpate your sprained ankle and it's not comfortable, but they do it just to figure out, okay, well, where is it and what's. How severe is it? And so this is where we're going to do our acoustic reflex thresholds. You'll find that, yes, these diagnostic tests that we can build to insurance are very, very helpful.

But the tinnitus questionnaires. So scientifically validated tinnitus questionnaires are probably more useful when evaluating a patient with chronic bothersome tinnitus. That's really where the most important stuff is. And I personally, in my clinic, I use the Tinnitus Functional Index and Tinnitus Handicap Inventory. Mostly.

I was trained on using the Tinnitus reaction questionnaire, the TRQ. There's several others. There's roughly 10 that are commonly used. The TFI and THI are the ones that I personally use more. Okay, now people do.

Well, we're all. At least. I was trained in doing a lot of psychophysical measures of tinnitus. Pitch, pitch and loudness matching. Measures of minimum masking level, measuring whether or not the person has residual inhibition.

There's a software called it the Tinometer. T I N N O M E T E R. It was developed by some folks in Europe. It was licensed, I believe, to Medrex, and I've used it. I think it's pretty cool.

But I also, I don't do pitch and loudness matching. I'd say I probably have done it once, maybe once in the last year or. Yeah, I haven't done it in 20, 25 yet. Minimum masking level. I will conduct that partly because it can be helpful in.

In counseling the individual that, you know, your attendance sounds really loud to you. However, you know, we were able to consistently mask it with about 22 decibels of pink noise or speech shape noise. It's. Yeah, it turns out that it doesn't take very much masking in order for it to shift your attention to your tinnitus. That's really cool.

So that can be helpful. Residual inhibition where you're playing a sound that's above their minimum masking level and present it for about 10 seconds and then stop it. If their tinnitus then stays down, even in silence that's not therapeutic other than it helps to show that sometimes your tinnitus in fact can be shifted if you don't have any residual inhibition. If you turn off the masking, you know, if you have a, a masking noise that is effective at masking their tinnitus and then you shut off that masker and their tinnitus is there, you know, immediately that doesn't mean there's anything wrong, it just means that they don't happen to also have residual inhibition. One question that popped up here, coming to this because it's part of our assessment individual had indicated I certainly help the person understand but I find it very informative.

Um, if you get a Moro reaction and have a recruitment as in the audiogram doesn't match the acoustic reflex threshold being triggered. Are you looking for any of this? Anything that else you look for in the acoustic reflex threshold? Specifically what I'm looking for in the acoustic reflex threshold is. There we go.

Specifically what I'm looking for in the acoustic reflex threshold is if somebody says yeah, loud sound really bothers me, I can't be around loud sound. I wear earmuffs. Every time I go out the question falls to are they guarding against loud sound exacerbating their tinnitus or is it actually causing pain? So one I would say is more, let's see, how can I put this one is more cognitive and psychological. That's that guarding behavior, guarding against their tinnitus being made worse by loud sound.

And the other one is more of a peripheral hyperacusis. And one way to discern the difference there is if you get an acoustic reflex threshold that's at 65, 70, 75 decibels. I think we'd all agree that's that reflex threshold is below what would be normal. In that case you really are looking at the person using hearing protection devices a fair bit. Not when it's quiet, but they are going to be using them anytime there's more than a couple of people talking.

And your tinnitus retraining therapy efforts are really going to focus around helping to up regulate those inhibitory neurons that have really down regulated as a consequence of their condition. That's we'd have to get into some, some good detail on how we might go about doing that. So with our acoustic reflex thresholds, that's specifically what I'm looking for is are they at a normal level or even above a normal level? Is there anything, is it normal acoustic reflex thresholds or are they abnormally low? That's probably the best way I can describe.

Let's see, another question popped up and I'm going to take a couple and then we're going to continue to move on. Otherwise I'm not going to get to some of the stuff. I want to make sure that we do. How do we. Oh, I think that I just answered this question.

How do we differentiate from a psychosomatic response so that guarding behavior, as I've seen like a hypervigilance, can trigger a funky acoustic reflex threshold? So it turns out that yes, your acoustic reflex threshold, you may actually get an acoustic reflex at lower levels if the person is anxious about it. There is a bit of a top down action where you can trigger a reflex if you're afraid of what's about to happen. I've only seen that shift things by about 5 decibels.

We're definitely not measuring with an outrageous amount of precision. We're looking at bigger. Hey, is there a reflex threshold at 85, 90, 95 or is it 80, 75 or 70? One last question here. The individual asked that I please speak a little bit about tinnitus related to cochlear concussion subsequent to automobile accident.

Does that ever subside, even in part? And if so, how long after the event would one want to wait and fit that patient with a masking device? Oh, I love that question. That is some good stuff. We'll talk about cochlear concussion.

Okay, with acoustic reflex thresholds, someone had indicated, are you looking at the size of the response or only the decibel level?

You know, it's interesting if they go from no response, if the acoustic reflex tracing is pretty flat, like very little response, and then you present, let's say at 75 you don't get a response. At 80 you do get a response. At 85 you get an even bigger response. I can tell you I don't show acoustic reflex growth as I go up. If a person is sound, sound sensitive, I'm just looking at what threshold you've got it.

But in someone who allows you to do that, it is interesting to see. Do they go from just barely a reflex and then a huge one just 5 decibels up, or is it just at a normal increase? The magnitude of the reflex increases as one would expect as you go up in the reflex presentation level. There is something to be said about the size of the reflex response once it's triggered. A little bit of a soft answer to that one, but that's the best I can really describe because we're kind of figuring this Stuff out.

Now, as I indicated, I love questionnaires. It whether the tinnitus is bothersome. Not bothersome is not about the perception of the sensation. It's about their reaction to it. And hearing tests, even pitch matching, loudness matching is not getting at how bothersome it is.

It's just characterizing some properties of the tinnitus, their perception of it. Whereas questionnaires are getting at. In what ways does it cause you a problem? So the two that I mentioned that I use are the Tinnitus Functional Index and the Tinnitus Handicap Inventory. Okay.

Specific to the Tinnitus functional Index, a reason why I like it is it, it pulls out and kind of defines these eight subdomains of 1. What's bothersome about the tinnitus? How intrusive is it? Okay, so that's like, yeah, how loud is it and how annoying is it? Okay.

But it also gets at things like sense of control or loss of sense of control, interference with your cognition, interference with sleep, disruption of, you know, your ability to hear and understand people, perhaps separate from a hearing loss, interference with relaxation, disruption in quality of life and emotional dysregulation. Those are eight interrelated but independent subdomains that describe why the tinnitus is a, is a problem. Now, global score, you get a global score from all of this as well as subsets, you know, sub scores in each of these domains. A change of 13 points from a baseline to a follow up, that would be considered significant, that is a difference better or worse. That's that 13 point change would be what you consider to be a minimal clinically important difference or the MCID.

Minimally clinically important difference in the TFI. That's a 13. Now, thinking about interventions, what do we do about it? If you see a tinnitus patient, first off, you've only seen one tinnitus patient. Every tinnitus patient has their own unique thing about them.

Something that is pretty common though is that oftentimes they've been informed by a well intentioned clinician, whether that be an ENT, primary care doctor, neurologist, another audiologist will oftentimes have said to them, well, you just have to learn how to live with it.

I cannot stress enough how important it is to not say something like that because while it's not incorrect, the communication of it, and we are communication experts or we're supposed to be, when you present a message to a person that you know, you just have to learn how to live with it, that conveys a sense of hopelessness that can really cause people to spiral. I've actually done some writing and some presentation on the trauma associated with the medical workup of a patient with chronic bothersome tinnitus from the hearing test itself, which, you know, especially if it was an acute onset tinnitus just

randomly happened, or it was associated with vertigo or it was associated with a traumatic event like the Boston Marathon bombing or a, you know, a car accident where an airbag deploys. Those kinds of experiences are in and of themselves traumatic. And then that trauma can be further, you know, increased by getting put into an MRI that's really loud, and loud sound is triggering their tinnitus. And, you know, God love the imaging technician, but they may not find that or they may not be equipped with helping to manage somebody who has severe emotional disturbance secondary to their tinnitus.

So it's important for us to communicate messages that don't deliver false hope. That is realistic, but at the same time is not eliminating reasons to believe that they will get better. Because there is a lot we can do. Okay, so speaking of things that we can do.

Well, as I noted, masking is a cornerstone of helping to manage tinnitus. So when I think of masking, that falls under a general perspective of sound enhancement. There's when the tinnitus is bothersome, the limbic system has been activated, the thalamus is giving too much priority to this sensation, and therefore we've got a mismatch between the excitatory neurons and inhibitory neurons. Sound enhancement serves to stimulate the auditory cortex. And in fact, if you're giving it more and more and more stimulation, then the inhibitory neurons kind of have to get their act together and say, oh, I guess we better do our job and give them a bit of ability to tolerate some of the sound that's coming in.

Generally speaking, we're not looking to enhance louder sound. Certainly not. We're looking to enhance soft sound. Now, we also can use sound enhancements such as masking so that the individual is not in silence ever. Silence is not their friend.

And so we want to have some other sound that's going on. A cornerstone of tinnitus retraining therapy is re establishing a sense of control whether or not they hear their tinnitus, and using that sense of control to allow the tinnitus to be present under a controlled environment and then give the brain reason to tolerate the presence of that tinnitus to the point where eventually they no longer have a reaction to

it. So I don't endorse Resound as anything other than it's one of the manufacturers that lots of us use. So six major hearing aid manufacturers in the world Resound being one of them. They make perfectly good hearing aids, as do the other five.

I happen to like their Tinnitus Relief app. So Resound. Tinnitus Relief is an app that is free, doesn't take people's information, and you have a lot of control over the soundscape and you can create many of your own. This happens to be my preferred masking sound.

So this is rain with ocean waves. And I actually have some monks chanting in there. It's very, very low frequency. And I don't really hear it over my headset, but there's some monks that are going, bull.

There's a wave crash. So if I have tennis going, and I have. And I have my masker going, this actually, this is how it sounds.

So some of the low frequency component of my tinnitus is still coming through. However, I'm hearing more of the rain and more of the ocean wave crash than I am the higher frequency components of my tinnitus. That's pretty nice. And so if I increase the level of my masker there to a level where I don't hear my tinnitus, then that means, yeah, very nice. I've just established control.

So it's important for us to consider then, that we are managing tinnitus like we manage many other chronic health conditions. We're not looking to cure tinnitus because tinnitus is a byproduct of how the ear works. It's the circuit noise. The auditory system and all electrical systems have circuit noise to them. Our eyes do, our hands do, our refrigerator has circuit noise in it.

Our computer, of course, has lots of circuit noise. So it's just a byproduct of how this works. Management is, for instance, having diabetes. You manage your diabetes, you don't cure it, you manage your myopia, your need to wear eyeglasses. You're managing it.

Migraine, you're managing migraine, you're not curing the migraine. And with our tinnitus, it's important for us to appreciate and understand that while the person just wants the tinnitus to go away, that would be habituation of perception. If that happens, and it's not that it can't, but if it were to happen that their tinnitus were to actually get quieter to a point where they're not detecting it anymore, they first have to no longer care about it. That's the irony of tinnitus therapies, is in order to make the tinnitus go away, you have to not care whether or not it goes away. That's a tough one.

But when people experience a habituation of their reaction and you say whether you hear your tinnitus or not, you won't care if they get to that point. And oftentimes they do. When they get to that point, they say, yeah, I didn't believe you when you first told me, but it's true. Sometimes I hear my tinnitus, sometimes I don't hear it. But whether I hear it or I don't hear it, it doesn't matter.

Specific to tinnitus retraining therapy. And this is not a course to get you certified in trt. But understand, big picture is our role as the audiologist is to provide informational counseling. An educated patient is effective. They can be overeducated.

Don't be. Don't be too concerned if someone comes in with a stack of research articles that they've read all of them and made notes on them, and they're now going to quiz you on how well you understand these different articles. That's somebody who is highly motivated, but also is going to be some work. Well, you are their coach. You are their teacher.

They want to be educated, and they may, in fact, have misinterpreted some important information. So it's very important for us to, in a very caring sort of way, help them to better understand the experience that they have. And it's really important for us to give a focus and consider that there's your perception and reaction, and those two can be separated, that there is a separation between your perception and reaction. One of the things we do, I showed you that charcuterie board of tinnitus, that this really comes

from a place of, well, two different parts of your brain. The perception of it and the reaction to it are separate areas of the brain.

Okay, if we identify that minimum masking level, if a person even has a minimum masking level, we want to drop that masker then just by one more decibel, so the tinnitus is just barely audible. That's what Jastreboff would refer to as that mixing point where the tinnitus is just barely peeking out over their masker and allow it to be there. Now, I don't do that immediately. I give people full control over their masking, allowing them to turn the masker to a level that they feel they are in control over whether or not they hear their tinnitus. Once they're able to tolerate some periods of the tinnitus being present, then I put them down to where, okay, let's find out just where.

You just barely hear your tinnitus. And now let's kind of try to be there for as much as we can. The whole purpose then to facilitate habituation reaction. So when, right to the meat of this now, when we're fitting hearing aids to people, I cannot stress enough how important it is for you to get their loudness, discomfort levels, their LDLs. Program that in to the hearing aids.

Because if the hearing aids are set too high, the gain for 80 decibel inputs or your MPOS are too high, then the use of their hearing aids may trigger their tinnitus and you're going to have a heck of a time getting them to start wearing them again because they're going to rip them out when the tinnitus is exacerbated by the, by this bearing in mind, even if they have a hearing loss, if they're presenting to you or tinnitus management, we're not trying to fit the audiogram. Our primary goal is management of the tinnitus, okay. Secondary goal may be audibility and improved communication. That secondary goal does support the primary goal, okay. However, primary goal is that we want to help them, okay?

We want to help them in managing their tinnitus. I do recommend that whatever venting you use, and I do tend to use custom ear molds on everybody, even people with low normal hearing from 250 up through a thousand hertz. I use ear molds because it stays put better. We direct the sound better if it's a

very well done ear mold and I strongly encourage you hold out for a very well done ear mold. Generally speaking, you can vent those like crazy.

You could do trench vents, you could do IROS vents and you can get really good external sound so you don't have occlusion effect. What we're trying to do though is we're trying to give good emphasis of soft sound gain to allow for environmental masking. Okay? Because we have LDLs, we know that the higher level inputs in your MPO, we can bring them lower, err on the side of those being low, even if it sacrifices sound quality a little.

I know this is a little weird, but turn off noise reduction to an extent, you know, and just adding this on, have more, less directional mics and more omnidirectional mics. Just allowing ambient sound to come on in. With that in mind, don't turn on expansion, okay? The idea of expansion is that it doesn't start providing gain until the sounds get above a certain level where speech would exist. No, we want that soft sound.

We want them to be aware of all of these other environmental sounds that people usually are annoyed by. Like the sound of their feet walking on, you know, across the carpet or this, you know, these other sounds, we want them, okay, 65, 75 DB inputs. Have them at or below the adult fitting targets. And do real ear measures. Do real ear measures.

Do real ear measures. I can't say enough. Do real ear measures. Okay. Show that the signal that you're presenting for 50dB, 55dB input is close or at targets, but that your medium and loud sound inputs are below your targets.

It's important that you do that. Have your feedback management on. Nobody wants to have a squeal in their ear, especially if they're sound sensitive. Have your impulse or transit noise management. Have it on, make it aggressive.

Okay. You know, I personally don't like the onboard tinnitus masking programs. Fractal noise, notch noise, shape noise, whatever is on them. I really like using hearing aids that can stream the resound relief app or another tinnitus app. I like it.

I also get that not everybody wants to wear a receiver in the canal hearing aid. I fit a lot of invisible in the canal hearing aids. I fit a lot of cics, but big fan. I do like to be able to have a push button on the device. That way they can go from a general program without masker on board to having a masker on board.

That said, if somebody needs an invisible in the canal, there's no room for the push button. Then sure. Turn on the onboard tinnitus masking. What's imperative though is that the sound that you deliver, the masking sound you deliver, is vaguely pleasant and easy to ignore. Okay.

And at a minimum, that the masker is at least not as annoying as the tinnitus is.

Look at that. There's my slide on that. So I know we're probably coming to time, but I want to make sure that we're in good place here. Here's just an example of an individual that I worked with a little while ago. I say a little while ago because, well, his TRQ tennis reaction questionnaire was really high.

Okay. He presented as having hyperacusis. Turns out he didn't have hypersensitivity to loud sound. He was just guarding against it that, that psychosomatic trying to push against it. So yeah, this is definitely quite a, quite a significant noise induced hearing loss.

And in fact we see that he, he has A real need for audibility. All right, I'm going to skip these presentations of signal just because the pieces that I want to get to are there. Let's just note, though, that music doesn't sound great. Through his hearing aids, however, it improves as we provide sound

enhancement. It does help him to hear better.

Here is our probe mic measures. He was afraid of his masker causing his tinnitus to be worse because loud sound damaged his hearing and so he didn't want to. Loud sound. Actually, this is not the same individual. Just to note, this is another person.

But the massacre that we were presenting was at such a low level. It wasn't nearly up into like the 70s or 80s where we might consider that we might have some overall level exacerbating some tinnitus. Showing them on a piece of paper that, yeah, it turns out that this really is not going to make your tinnitus worse. Gave, you know, gives these individuals permission to make use of their maskers. Okay.

It's important for us to be familiar with the pharmacologic interventions for tinnitus. Okay. There are no interventions for tinnitus specifically, but it can so. So zoloft, Lexapro, other SSRIs, like Prozac, benzodiazepines, you know, your Klonopin, your Ativan, your Xanax. These suppress a reaction to the tinnitus.

They don't suppress the tinnitus itself, but they help to manage things like insomnia and attention deficit. They can help to manage your anxiety, your depression, your negative repetitive thoughts. Some neurologists will recommend gabapentin, which is a medication for nerve pain. They'll prescribe it for tinnitus. It has a bit of an effect of making you drowsy, and that's like benzos.

They can make you drowsy and so they may feel better. The problem is that gabapentin, you may have to increase the amount of dose to get the effect. So that's dose escalation. And over time, it starts to really make you wonky. So gabapentin does not treat tinnitus.

It is a nerve pain medication, but it doesn't treat tinnitus. Some people do very well if they have terrible sleep. A lot of folks do. We do need to address the sleep piece. Trazodone has been around forever.

Animals can be given trazodone like dogs post surgery. Humans. Trazodone is pretty typical. One of the side effects to it is dry mouth and then some sleepiness the next day. Melatonin is over the counter or dietary supplement.

Some people may get some benefit from melatonin. Okay, I hear it. My limbic system thinks it's a threat and now I can't ignore it. This circle is what needs to be broken. Okay, Any of those places along there between.

Well, whether it's your, your reflexive attention to it, it's your reaction to it, or the fact that you hear it, these are three different areas that we can help to address. Okay, do your full workup, but know that the workup really should be driving what your management is going to look like and not just checking boxes of. Well, at least I can bill for this, you know, to the insurance company. Management of chronic bothersome tinnitus is really focusing around setting devices, getting an individual to use devices, and addressing the tinnitus specifically as your primary goal, with improvement in communication as a secondary goal. This means that we are giving more emphasis to soft sounds.

We are not doing noise reduction, or if we are, which is just very minimal, you're going to use these devices to have them enhanced in sound at all times. Okay. So to that effect, I want to make sure that I hop right back to it. One individual. So one of the questions earlier was around cochlear concussion.

And bear in mind that head trauma is strongly associated significantly associated with, with tinnitus. And when we're thinking cochlear concussion, I think of that as some of these acoustic traumas. Airbag deployment, depending on if the windows are up or down, can result in an acoustic trauma. Sound levels can be up above 170 decibels, up to about 175. That can result.

Well, not only you have this emotional trauma, physical trauma with it, but as well you can have cochlear injury. The question was how long before it subsides? How long before you fit with a masker? I say fit with a masker immediately because this person needs to experience a sense of control. You don't wait to see whether or not it decreases if it goes down and goes away.

You know, I mean, technically, if they don't need to use sound enhancement, then the person could return the devices. You should charge for your time, but the person could. Could return the devices if it ends up not being necessary for them to keep it permanently. I hope that that answers that particular question. Let's see, what else do we have?

Gotta pull up my notes.

Let's see.

Sorry guys, I've got to get my screen. There we go. Here's my Q and A. Thank you so much, guys.

Ah, One person had asked a couple of minutes back if that the. The sound that I presented in the Resound Relief app, was that my creation or one of the canned options that the relief app has? I created that at the bottom of those little circles that they have, there's a plus key I'm a big fan of. Just hit that plus key and just make all of them that you want. Okay, let's see.

Eric, thank you. Just noted one of the best synopses of tinnitus therapy. Thank you. Well, I appreciate that. That was really nice of you cool folks.

What else? I mean, I'm personally not in a huge hurry, but I know many of you are going to have to boogie out, so I'm going to keep on going. When choosing a masker, will you go through the manufacturer choices and if none are liked, then from an app to see which is preferred in the app

choice? And how will you proceed then with the relay measures? By default, if they will use a receiver in the canal device or a device or some any device that is Bluetooth enabled, I pretty much just by default just go right into the Resound Relief app and use that and say here, let's really focus in on coming up with three to five soundscapes that you find vaguely pleasant, easy to ignore.

So we don't just have one because that could get boring and annoying over time. And so switch to something else if the one that you've had your go to starts to get a little bit old. That said, if you don't have Bluetooth enabled, then, or a person doesn't have a smartphone or they don't want to have to have their smartphone, then I'll start to go through some of the different onboard masking. Once we decide on what their go to masker is going to be, that's when I'll do my probe mic measures. I'll verify the frequency gain in the different programs relative to their targets.

But then I'll also switch over and do live speech mapping and just have the masker going and so you're silent. There's no signal coming out of the speaker, no Itas noise or whatnot. You'll just be measuring the sound being presented by the device in the ear. Okay. And another question popped up.

At what point do you start the tinnitus billing and education?

So with our program and we do so my office, we're a private practice in downtown Boston. It's almost 90% of my caseload these days is a patient with chronic bothersome tinnitus. We start that education piece before they come in. So we send out to them through our office management system a bundle of information, questionnaires and agreements for them to sign that they agree and understand that we will bill for the diagnostics, we cannot bill for the therapy. We can give them a copy of that CMS 1500 form if they would like to submit to their insurance for reimbursement.

In case their insurance does, it's an acknowledgment that this is what the cost of the therapies are and that they'll, they'll review those options with their audiologist depending on if they qualify for one therapy

approach versus another one. In that, in that same document, I include things to the effect of if you've ever been told by a well intended clinician that you're, you know, there's nothing we can do for your tinnitus, we're sorry, that's not completely incorrect. However, it's also not the right way to present this because there is a lot that can be done. And so from an educational standpoint and from a counseling standpoint, I put it right there in writing from the start. Okay, let's see.

I think that's what I've got. Any others, any other questions popping up?

All right, well, so folks, I just want to mention on behalf of Audiology Online, the exam isn't going to be available immediately right here. It takes 10 to 15 minutes for the organizers to include you in the census of people who attended this. And so once you're logged in on that, then you can go into your Audiology Online account, you can go to your pending courses, choose to take the exam, and then go ahead and take it. Credit will be made available for you doing this live if you do it within seven days. So to that end, folks, thank you so much.

I enjoyed this thoroughly. One last question. What do you, what do you fit on a patient with normal hearing and significant tinnitus? I fit a less expensive hearing aid, kind of like if I don't need to provide them better audible or, sorry, improved audibility. I will get one of the, like, level five, level four devices so that I save them a little bit of money and so I bill them for the devices separately and I bill for attendance, retraining, therapy as a service package separate from the devices themselves.

Okay, so again, thank you all. Glad I was able to chime in on some of those last bits. All right, be well.