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Success Factors:
Efficient Integration of Real Ear Best Practices
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Presenter: Elizabeth Thompson, AuD

- Welcome everybody, and thank you very much for being with us event today. My name is Anna and I'm an education manager in Inventis. It is a real pleasure for me and for Inventis to have all of you here today for this webinar on real ear measurements organized by Inventis, but completely conceived by the lovely Elizabeth Thompson, owner and founder of Hickory Audiology in Bloomington, Indiana. Elizabeth is a clinical audiologist, innovator, entrepreneur, and leader within hearing care. Throughout her nearly 20 year career, she has developed a product and businesses that improve hearing health and wellness through state of the art ear technologies. Elizabeth, I'm very, very happy to see you again. Thank you very much for being with us. Elizabeth-

- Thank you very much. Go ahead.

- Elizabeth. Sorry.

- No, I was gonna say thank you for the wonderful introduction.

- Okay. This is the third webinar that Dr. Thompson runs for Inventis since the project Academia was born. Elizabeth is a great professional and I feel that we can only learn from Dr. Thompson. Title of the seminar is Success Factors, Efficient Integration of Real Ear Best Practices. Developed of course is not only to deliver efficient solutions that you can integrate in your office today, but also expand your thinking about ways to use real ear in your clinical practice. As usual, I invite all of you to write out any questions in the space provided that you should see on the screen. After the event, you will receive a survey. I currently ask you to fill out. The survey will help us to understand your needs, to get your ideas in order to provide with the best educational support ever. But now, Elizabeth, it is your turn. Enjoy the show and see you later.

- Very good. Thank you so much, Anna. That was a wonderful introduction and I really appreciate your introduction of me. It made me sound very special, so I appreciate

that. A little bit about the agenda of what we're gonna do today. We'll start with some introductions, then we'll talk about the importance of real ear measures, really how to set up your practice, your equipment, and your scheduling for success, evaluating hearing aids, using real ear measures, and the impact on your business metrics. I won't go over today the nuts and bolts of how to execute real ear with the Inventis machine. There's a lot of courses available on the Inventis network to show you that, but I'm really gonna focus on how are we positioning real ear within our practices to make you and your practice successful.

The learner outcomes. After this course, you'll be able to talk about the benefits of real ear for your patient and your practice, and you'll be able to use how you're using real ear measures to even evaluate maybe non-traditional hearing products. So full disclosure, I am the founder and owner of Hickory Audiology here in Bloomington, Indiana in the United States, and I have no non-financial disclosures to announce to you. So a little bit about me and how I think our experience has really shaped our perspective of how we ended up where we are. I am a tried and true Hoosier. I was born and bred in the state of Indiana here in the US and I even went to Indiana University for my undergrad and my master's degree.

I was studying to be a biochemist and my professor was like, hey, you talk a lot, like a lot, a lot, and I would think it maybe would be good if you were in a profession that was more helping people. So that's what I decided to do and went into audiology. I spent my early career in the field with patients one-on-one working in a variety of different settings from ear, nose, throat, settings to clinical private practice settings, hospital, and then ended up actually teaching at Indiana University as well and doing some research. Then I went to work for a hearing aid manufacturer. So I spent 10 years at Phonak in a variety of different roles from clinical support to outside sales and then ultimately in marketing and product development product management at Phonak.

I left Phonak and went to Lantos, which is a company that does some ear scanning technologies, and that's really where I caught the entrepreneurial bug. And at Lantos, it was really my career was really about how do we take technology and transform it in the use of the clinical setting. And around almost three years ago, three years ago next month, I started my own private practice, Hickory audiology here in Bloomington, Indiana. And we've been open three years focused on adult healthcare and the use of clinical best practices within our community. And so have had amazing patients and just a lot of success and a lot of happiness in my own private practice. So kudos to all the other private practice owners out there.

Okay, so let's talk about verification methods. So we all, any of us that are fitting hearing aids, are all doing some form of verification with our patients. I really isolate verification into three different buckets. There's the patient self-report, which we're really using the patient's response, how does that sound, right? There's functional gain measures where we're taking the patient into the booth and doing some measurements there. And then there are real ear measures, which has come to be known as the gold standard for verification. And we're gonna talk about all three of these methods. So first, we've got the verification method of, hey patient, how does that sound? This is really used widely, we all do this.

We all ask our patients how does it sound when they first get that hearing aid. Some of the challenges with this method is that you really don't have any idea about the SPL level of the, that the hearing aid is performing at the tympanic membrane. So while we can say, the patient can say, hey, it sounds great, but it may not be loud enough to actually overcome their hearing thresholds. We also really have no indication of how much amplification they're getting as it approaches that max power out and any kind of uncomfortable loudness levels that they may have been experiencing. A lot of times this method really relies on the manufacturer to use their algorithm for how much amplification they should be providing that particular patient.

So a lot of times, patients are being fit to first fit on manufacturer software and then we're asking, how does that sound? But their answer to how does that sound is an important thing to know, right? If they think it sounds too loud or too soft, we need to know that and address it appropriately. The second method of verification that we're all taught in school is kind of taking them back into the booth or getting some sound field measures for them. So for this, you would take the patient back into the booth and then using your speaker system, have the hearing aids in place and present some tones or speech and see how much their response has improved from their hearing evaluation.

While this is effective, it really still doesn't tell us what's exactly going on at the tympanic membrane of how much SPL is provided that patient. There are limited frequency and volume resolution, so we're only testing, you know, every octave, you don't know what's going on at 3,600 hertz, we only know what's going on at 3000 and 4,000 hertz. And with this method of verification, some of the hearing aid features can become problematic. So some of our noise cancellation features that are being used in the hearing aid will actually inhibit the amplification for a tonal stimulus that you're presenting in the booth. So I would say that I don't see this being used very much for verification anymore. There are still some insurance carriers that require, at least here in the US, some of our Medicaid programs still require sound field measurements to be done aided.

So if you do that, you do that, but it's not a method that we're using a significant amount in the US at least. The verification that has really become the gold standard is real ear measurements. So real ear measurements is the ability of, you're using some external equipment to measure what actually is happening in the ear canal through sound, through a measurement of sound pressure level, of SPL. So we wanna know exactly what's going on for that patient in that patient's ear with that patient's ear

acoustics. This will also allow us to assess how much MPO, what the max power out is of the instrument that we're providing in that particular ear canal. Easy to evaluate, to target.

So there are targets that are created and recommendations for the patient that we have and the software that we can use or we can measure to audibility, and we'll talk about both of those things. You can also evaluate the hearing aid in the real world with their features activated, right? We wanna be able to use everything that the hearing aid has to offer, and we wanna know what is that response with the AI features or the noise reduction features in play for that hearing aid. And with this method, it's super easy to evaluate at multiple input levels so we can get, you know, 50 DB, 65 DB 80 DB, or anywhere in between within a matter of seconds versus if we were doing this in the sound booth, it would take forever to evaluate all those different input levels.

But the question is, why do we need to do this? Why do we need verification? You know, verification does a couple different things. It's gonna A, ensure that your patient has audibility for soft sounds and average sounds. I had a professor at Indiana University by the name of Dr. Larry Humes, who used to tell me all the time, if you don't have audibility, you don't have anything. If your patient can't hear it, they're never gonna be able to understand it. And so our job is to make sure that the instrumentations that we're using, the hearing aids that we're using, are providing adequate audibility for patients for soft sounds and average sounds. We also need to make sure that we are not exceeding any measured or estimated uncomfortable loudness levels, UCLs.

Patients won't wear hearing aids if they're uncomfortable. And as we all know with hearing loss, it often comes that there are some recruitments or diminished acceptance of loud sounds. So if that patient is experiencing diminished acceptance of loud sound, we need to make sure that the hearing aids aren't gonna exceed their uncomfortable

loudness levels. It also allows us to do independent verification of hearing aid functions. Are the hearing aids working the way that we, that the manufacturer said that they were gonna work and that we've promised our patient that they're going to work? So it's our job to verify that. And the last one is, our patients are humans with real ears. I've never met an ear canal that was the same, even between ears.

Sometimes they have different acoustics or different curves. And so at the end of the day, the ear canal is a tube that's closed at one end and it has specific acoustics and characteristics that we need to measure so that we can have the hearing aids work in conjunction with the acoustics of that patient rather than work against it. Okay. So what are the benefits of, oh, and I saw a question come in. Since we're on the topic of verification right now and there are some agencies required sound field, can real ear be validated as a replacement for sound field? It's a great question. I would check with your individual insurance carrier. In the state of Indiana, we have one insurer that is still demanding sound field testing.

So what I've continued to do and advocate for for my patients, I do the sound field testing, but I also do the real ear testing and we send both results in to that insurer. And I have a meeting with that insurer next month to try to work with their educational support committee to see if we can get this changed where, you know, where we're doing verification through real ear measures versus sound field. So, you know, certainly, I would encourage any of you who have insurers or agencies who are requiring sound field, start with education with them. If we can do real ear, it's a better method for their patient and for their providers as well. So, good question.

All right. Benefits of integrating real ear measures into your practice. So this is one that as I've kind of been holding the torch for verification measures for a long time with all the speaking that I've done, you know, throughout my career time and time I hear again that providers are somewhat resistant to integrating real ear measures. Some providers

say, well I don't have time. It's just one more thing that I have to do and now I have to program an app for my patient's hearing aids and I don't know how I would integrate it into time. So time is always a big question that comes up. I would attest that time actually can be saved with real ear measures.

And what I mean is you have to play long ball here. It's not that it, yes, it will take a couple more minutes for you to set up the equipment and to run the real ear measures at the patient fitting. But in the long run, this is gonna save you time with your patients. So some of the research that's been done shows that the number of patient follow up visits, it's actually decreased if you use real ear measures. AKA, if we do a good job and fit the hearing aid well from the beginning, patients don't have as many problems and they don't have as many follow ups. I've definitely seen this be effective for the reduction in time of fine tuning for, we all know who those patients are, right?

So those patients that are really persnickety or really have want you to do lots of little bitty changes into the hearing aid, I have found that with that patient, if I explain, here are the verification measures that we're doing, here is what this software and this technology is allowing us to do, they have more faith and trust in me, the professional, and in the hearing devices that then they're not as apt to ask for all these little fine-tuning changes because they know, hey, it's not reliant on my report, but instead, we're relying on technology and innovation to help set these hearing aids for me. I do a lot of discussion with my patient about, we're setting a prescriptive hearing aid for you.

We've put your hearing test results into the computer and it's generated a set of rules for your hearing aid to follow. And what we're doing with the verification equipment is measuring to make sure that your prescription is being met with your ear. When you explain to patients that, oh, this is really about technology that's driving the decisions that we're making, they're less apt to want things tweaked, let's put it that way. And then there is value in getting it right the first time. There's nothing greater than when a

patient comes back in and says, oh gosh, like you hit it, you nailed it. I don't need any changes. That not only means that they have faith and trust in you as the provider, but also in the technology.

It just snowballs from there. Patient satisfaction I feel like is a great benefit of using real ear measures. My patients are happy. I've, once again, Dr. Hume's coined a phrase called benefaction. So the combination of benefit and satisfaction. You can have a happy patient that has a hearing aid that's turned off, right? They can be happy with how it sounds 'cause it's not doing 'em any benefit. So what I really look for in my clinic is this combination of benefit from the technology and satisfaction. So benefaction. A new word for you today. And then the final one, you know I can't get this online. This is, you know, whether it's big box stores, but some big box stores here in the US actually do verification measures, but, and or over the counter type products.

Verifying the fitting for that patient in your office is not something that can be replaced through an online method or algorithm. A good question, Kim. Should I use real ear for all patients or only for troubleshooting? I'm now hold that question 'cause I think it's gonna be better fit later in the presentation. I'm gonna bring up that directly. Now if all of those time savings and benefaction saving reasons weren't good enough for you, it's also considered clinical best practice. Our patients are looking for, looking at our procedures and they wanna know, hey am I, are you following best practices? Are you following what's out there? And so you just have to do a Google search of real ear measures best practices and you're gonna see site after site after site, reputable facility after reputable facility who's gonna come up and tell, talk about real ear measures being best practice.

There's also an audiologist in the United States, Dr. Cliff, who has done a kind of a cool thing of educating patients through YouTube about the importance of best practices and he talks a lot about real ear. So if you're not doing it because it's good for your

practice or good for your patients, maybe do it 'cause the internet told you to. No, I'm just kidding, right? But we do wanna follow best practices. And what I've seen is that patients come in and they're expecting this, they're expecting real ear measures to be done for them. And so it's a good thing to integrate into your practice from that. So what are real ear measures? They're a valuable and repeatable method for assessing how much SPL is delivered within three to five millimeters of the tympanic membrane.

They're performed to check the hearing aid performance while it is worn and also to ensure that the hearing aids or outputs are comfortable and audible for the patient. A question came in about, you know, should I use these only for troubleshooting or should I do 'em all the time? In our clinic, our method is to every patient on a new fitting is given real ear measures. That's the only way that I can ensure audibility for that patient. Another question came in is how do I or, how we can fit hearing aids for severe hearing loss? Absolutely you can measure severe hearing loss with verification measures. You just put the probe tube in and you're gonna see exactly what hearing or exactly what amplification is provided for that patient.

So let's talk about the equipment that's necessary for real ear. You need a speaker, some kind of thing that's gonna make some sound. You're gonna need a probe microphone, which is gonna be placed within three to five millimeters of the eardrum. Some kind of reference microphone that's gonna be placed under the pinna. It'll all be part of your real ear system. And then a hearing aid or amplifier, something you're gonna put in their ear. If it's not inserted in the ear, it would be an unaided measure. If it's inserted in the ear but off, that's an occluded measure. So you're measuring what's the impact of having that device in the ear and off. And when it's in the ear and turned on, it's an aided measure.

So this is the real ear free field, the Trumpet system from Inventis. It's an amazing piece of equipment that allows you to have that speaker probe mic. One of the cool things I

like about the Inventis system is that it can be wireless too, so the patient isn't gonna be tethered to the machine that huge, like I dunno how many times I've been tangled up in wires in some of the other systems. So having that wireless system from Trumpet was a game changer for me. A little bit about the office setup. I'm a big believer in making sure your patient can see what's going on on the screen when they're doing real ear. Now does it mean mean that they should know every button and you have to explain all that to them?

Absolutely not. But having them see what is actually happening in their ear, I feel like is huge. It's an educational opportunity for the patient. So in my practice, what we've set up is a dual screen. So I found this monitor stand on Amazon and we have two screens and then on the bottom screen, I'll bring up the manufacturer's software so that I can manipulate the hearing aid. And then on the top screen, we have have the Inventis software so that you can see, so the patient and I can see what's going on when we're manipulating that scenario. I forgot to load a poll in this time and so I'm just gonna have kind of an open up into the chat.

You know, what scenarios are you using real ear for? Are you using 'em just for new fittings, for follow up fittings, for three to six month hearing aid checks, for hearing aid problems, or over the counter hearing aids, locked hearing aids, or do you never use them? So feel free, I would love to just hear from you guys and feel free to kind of pop in the chat and answer. When do you use real ear measures for your practice? New fittings. Anytime. Yeah, new fittings, acoustic parameters. Yeah. Perfect, perfect. You know, I think a lot of folks are using 'em for new fittings, they're using 'em throughout the course of the time. You know, for me, it can be all of these things.

Like I said, in our clinic, we're absolutely using 'em at new fittings. There are times though, there's a lot to go over at that brand new fitting. So sometimes for our patients, we actually do the real ear measurement at the two week check appointment versus

the new fitting appointment. Especially if I'm using any kind of auto acclimatization software. If they're a new user and maybe I'm starting that patient at like 90% to their fitting formula and instead of, and I'm giving 'em two weeks to get up to their prescription amount, I may, at that appointment, hold and do the verification at the two week check appointment. You have to figure out what works for your schedule. For me, we schedule an hour for our hearing aid fittings.

If I have to do, if I'm doing a new patient introduction with how do I get it in and care and maintenance, setting up their app, and any kind of connectivity to their phone, that's a lot to do in an hour and it's a lot for the patient to come in. So sometimes, I'll do the verification at the two week check appointment. That's totally fine. You do what works for your schedule. If it's a previous user who's very accustomed to putting the hearing aid in and taking it out, then absolutely you have time at that appointment to do, and they're gonna be fit at 100% to their target, absolutely you can do that at that initial fitting.

Watch out on impact of auto acclimatization softwares, right? You don't wanna verify the fitting and then have this software to 100% and then have the software be raising the gain on you and your patient 'cause now you're not where you were. So you really wanna make sure that you're measuring and verifying that fitting at the target. And then if any auto acclimatization is going on, maybe back it down and then turn the auto acclimatization on to that. For follow up fittings, if there's any change in the hearing aid settings, we re-verify 'cause I wanna know, hey, did that change in the hearing aid settings have a positive or negative impact on my patient. Evaluating the performance of the device over time.

Real ear verification can be awesome for that where you can see if the patient comes back and then says, hey, I'm not hearing as well as I used to. Of course, you're gonna listen to the hearing aid and clean it out, but you can also use verification to say like,

yeah you're not. Is the hearing aid drifting maybe? Does it need clean? Does it need a receiver change? You know, you can figure that out. And troubleshooting any hearing aid problems. Certainly, we can use that as a follow up. You know, for setting up the instrumentation, you wanna equalize the reference microphones on the patient and I saw a question come through about a person really having difficulty doing real ear measurements on open fit devices.

This is a good question and it comes up a lot. You absolutely can do verification on open fit devices. You do need to equalize the reference mics though. So we need to know how much sound is leaking out, especially low frequencies, is leaking out in that system. And so that's what the equalize will do. So there's an equalize button when you first start the Inventis software or the Trumpet software, which you'd wanna set up everything, equalize for that patient, and that's gonna help that bleed out from the, and allow you to do real ear measurements on open fit devices. After we equalize, we calibrate the probe tube and then place the probe tube in the ear and then select which test is gonna be, is for whatever you're trying to achieve.

So let's talk about the importance of probe placement in the ear. This is really critical in how you are achieving what you're achieving with your patients. We wanna put that probe mic between three and five millimeters of the ear drum. It's pretty deep. I definitely tell patients you're gonna feel a tickle, I promise this won't hurt, and then I just talk to 'em the whole time and I'm placing that probe mic into the ear canal. And you can definitely see them push or see them when it starts to tickle. If you just talk kind of, I use talk therapy through that, patients will let you place that in the drum or place that within three to five millimeters of the eardrum.

It can make a difference. If you're in a null of that open tube, you don't get the nice robust frequency response. And so what you see on the screen here are two ears. The left ear you can see is just not as robust of a response as the right. And so when I

moved that probe a little bit further in, that response changed. And so I knew I was in a bit of a null on that left ear and I needed to get that probe mic a little bit further down in the ear canal. So play with that. You know, when you're setting up your equipment, put the probe mic in a colleague's ear or a good loyal patient and play with moving that probe mic in and out and you'll see the impact that moving that probe.

But you want to get it into that sweet spot within three to five millimeters of the eardrum. And on the Inventis software, this is just looking at the unaided response, okay? So there's a lot of alphabet soup when it comes to real ear measures. So there's REAR, REUR, REUG, REOG, and people get kind of flustered on what all of that means. So we're gonna break it down. RE just means real ear. That's it. Just means that it's a real ear measure. It's a measure taken in a patient's ear canal. The letter in the middle, U, is for unaided. So unaided meaning open ear, no hearing aid in place. O is occluded. So this would be hearing aid in place and off, and aided is hearing aid in place and on, okay?

And at the end it's either a gain, it's a value of the probe. So you're either real ear aided gain, so how much amplification is being provided, or it's a response. So it's what is the absolute SPL level at that ear. So response is going to be total gain is response minus reference. So that's the difference. It's how much impact that specific hearing aid state is having on that patient. Yep, very good. The gain is your difference between the value and the reference. So, and luckily on your Inventis software, all of that is right here. I really appreciate how Inventis laid out their real ear measures. So across the top, you have unaided, occluded, and aided.

And then over on the right hand side, you have the SPL, HL, whether you wanna be in response or gain. So in this screen that I have up right now, we're in an unaided response. So this would be an REU, 'cause we're unaided, and I could either show it in response or in gain. The response versus gain is just math difference. It's just response

is gonna be the total, gain is gonna be total minus the reference. So it's really up to you on how you like to look at things. And there are times that I flip back and forth between looking at real ear aided responses and real ear aided gain. Just depends on what I'm trying to achieve for that specific patient.

So here's my method, right? First, I'm gonna do an unaided measure. So I put the, I've calibrated everything, I've put the probe tubes in the patient's ear, and I'm gonna do an unaided measure. Take seconds. And then I'm gonna flip next, go to aided, and I'm looking at real ear aided response here. And you can set up your protocols in your software to go through specific test. So in this particular example, we're using the ISTS, which is the international speech test standard. Yeah, international speech test standard stimulus. And so, and I've, the default on my software is to do it at 50, 65, and 80. So I'm doing a soft, a medium, and a loud response. And then you can actually set up your software to run these as kind of an auto protocol.

So literally it takes, you know, 45 seconds. The international speech standard, International Speech Test Standard, the ISTS, is a great measure. What they did was, this was developed like around 2012, and by the European hearing instrument manufacturer community. And what it does is it really isolates out any features that the hearing aid could have that could augment their response. So when we started to move towards digital hearing aids, there were certain features in the hearing aids that manipulated, that could be manipulated by a speech signal that was coming in where it would turn off a noise reduction algorithm and then you're not getting a true response. So what the ISTS did was develop a test that doesn't impede any of the algorithms of the hearing aid.

So I prefer ISTS. It's a great stimulus to use 'cause I know that I'm not getting any interference with the hearing aid features that I have. There are other stimulus that you can use, but I would encourage ISTS. It's just a great one out there. So what I do is I've

already done my unaided response, now I do my aided response, and I present at 50, 65, and 80. And what I see for this in particular case is that I'm a little under shooting, right? I don't have audibility through the majority of the high frequency range for 50, even though I'm at manufacturer's first fit. And I'm actually under fitted at 65 as well. So the little targeted line, the dotted line are your targets and the solid line is your response.

Here's to show you there are different stimulus that you can use, whether it's ICRA noise, the rainbow passage, pink noise, it's up to you. The world is your oyster. You use the fitting stimulus that's gonna be best for you. I'm just reading some of the questions that are coming in. Perfect. I'm gonna cover a bunch of some of these later. So let me stick with this for a second and then I'm gonna come back to questions. So there are other stimuli that you can use. So there's that aided response and so I ask you, like, would you be satisfied with this manufacturer first fit? For me, I'm not quite satisfied with this. it's a bit unfitting for my taste.

So what you can do is open up your manufacturer software at the same time that you have your verification software open. So one of the things Inventis has done is this on top mode. This is fantastic because it means that if you only have one screen in your location, like I said I have two screens, but if you don't have that luxury and you only have one screen at your location, you can have the on top mode of the Inventis software on the same screen as your verification software from the manufacturer. So then you can make manipulations to the manufacturer's software and see the impact and the changes that it's happening in your real ear as well.

So this is great. So after adjustments and some tweaks to this patient, you can now see that soft sounds are audible, medium sound is at or above target, and loud sounds are there as well. One of the questions that came through is that some manufacturers have an auto REM in their fitting software. What are better, using the Inventis software

or the auto REM? Both are better than nothing. I would just, with using the auto REM, I've used them and they can work great. I like to do the manipulation myself so I can sit with the patient and educate them on the manipulations that are happening. So I prefer because, probably because auto REM wasn't out when I was first taught, I prefer making the adjustments manually myself.

But auto REM can also do a really fantastic job. Your end result is the same, it's just whether you're making the manipulations or you're allowing the software to do that as well. Any importance on the order of the 50, 65 and 80? Good question. Not that I'm aware of. I tend to go in order of soft, medium, and loud. However, when I'm making adjustments to the manufacturer's software to match target or to make sure that audibility is there, I usually focus on 65. Soft speech I'm not as worried about as I am for everyday speech that's coming into the patient. So I really focus on 65 versus 50. But you can do 'em in whatever order, it doesn't make any difference. Yeah.

A question Kim, and are you able to run two different levels at the same time? No. So it has to be run one level per time, but using the ISTS, it's a bit faster than doing, like the rainbow passage or a carrot passage. If you're familiar with other verification equipment, those passages are a little bit longer where the ISTS, you can do a quicker burst. And so the ISTS, if you've never heard it, it's totally garbled. It is intentionally unintelligible so that the patient isn't like trying to listen for a specific word or anything like that. It's a combination of several different languages. And so it's a quicker snapshot but gives you the same amount of information across the frequency response, across the frequency range.

Okay. And then, yeah, you can do sequential tests. So within the Inventis software, you can set it up sequentially. So it'll go from 50 to 65 to 80 kind of one right after the other. Perfect. Okay. And I showed on top mode already and I showed the response after the adjustments. So the last thing I would do for that patient is an NPO sweep. So this is a

tonal sweep and you're really just making sure that your loudness levels are not exceeding, that you're not exceeding uncomfortable loudness levels either whether you measured them or predicted for that specific patient. So let's talk about evaluating the goodness of a fit. There's a big debate out there on whether we should fit to match a target, whether it's DSL NAL1, NAL2, or fit to audibility.

And I straddle these two camps. Targets are your tried and true. So these are things that have been developed and measured by the National Acoustics Lab in Australia and DSL up in Canada. And so these are tried and true formulas that ensure audibility for your patients. Some of the cons on fitting to target is that sometimes, patients acceptance can be limited. If you have a patient who's been a long-term non-user of hearing aids and then you try to give them all this amplification back all at once, they're like, ah, too much, and they wanna rip the hearing aids out. So for those patients, we have to compromise. The implementation of NAL and DSL across hearing aid manufacturers can be different as well.

So NAL for Phonak isn't necessarily the same as NAL for Oticon. And so if you are using match to target, you do wanna make sure in the manufacturer's software that you are also setting the hearing aids to that same target. So if you're using like a phone act adaptive digital, that's not necessarily gonna match NAL NL2, right? It'll be close, it'll be close, but it won't match directly. So you have to make sure you're looking at that for what's integrated into the software. The other camp versus match the target is audibility. And so this is really ensuring audibility for soft sounds, making conversational sounds comfortable, and that loud sounds are tolerated. So I call this the ACT procedure.

We want audibility for soft sounds, A, we want comfort for conversational sounds, the C, and we want tolerance for loud sounds, the T. So in this method, you're not dependent on manufacturer implementation of any kind of prescriptive formula and

that you are still ensuring audibility. The con to this is that it's not a validated test. So it's not something that NAL or NL2 or DSL has spent time validating and it can be different for every patient. So you have to do testing at 50, 65, and 80 to make sure that you're meeting all three of these criteria for the patient. It's really up to you. I think I, like I think I told you, I kind of sit somewhere in the middle of this two.

I always have the targets on the screen and look at the targets, but am also making sure that if I deviate from the target, I'm still getting audibility for soft sounds, comfort for conversational speech, and tolerance for loud sounds. There's questions coming in so let me just take a quick pause and look at this. There's some questions about the fitting formulas on Inventis. For example, I'm using e-stat formula for Starkey and what formula should I set my Inventis software to? I would have a conversation with Starkey around, are they more, is the e-stat more NAL like or DSL like? And if they're more NAL like, are they more NL2 like or NL1 like?

Most hearing aid manufacturers are gonna make a gross generalization. Most hearing aid manufacturers are more NL2 like now, 'cause NL2 is a little softer than NL1. But so NL2, you're probably gonna be close, but that's, but I would have a conversation with audiology support at Starkey as well. A good question, what's the best rule? You know, I think if you asked 10 different audiologists, you may get different answers. Like I said, I like the targets on the screen, but audibility is what I really care about. And part of that is because I have Dr. Humes always in my ear going in my head going what's the best hearing aid, right? The best hearing aid is the one that patients will wear.

And I think I had that in a slide coming up, but we'll cover it a bit early. If a patient refuses to wear the hearing aid because you've made everything too loud, that's not gonna achieve the benefit satisfaction level that you hoped. And so you can match to target, but if the patient won't wear it that way, you haven't done anybody any good. So we need to then go back and look at, hey audibility. On the flip side, if you have not

achieved audibility, what good is having that hearing aid in the ear? So audibility is something that I don't let patients get away with not having, right? They have to have that audibility. There was another question that came through about equalization.

I'm not gonna cover that directly, but there is just like, it's an, when you hook up Inventis and you open up the software, there's an equalize button that you can use, and definitely contact me and I can put you in contact with your Inventis rep too that can go over that with you. One of the other features that's in the software is speech intelligibility index, which you'll have, you can have these slides as well or you can email me and I'll send you the slides. But the speech intelligibility index is a great tool that allows us to see, predict how much benefit that patient would achieve with changes in audibility. Like what's the impact? So we've achieved audibility differences, but what does it mean for the patient?

How do we make sure that that amplification, that audibility is enough for the patient? So the speech intelligibility index measure was created to give us an idea of how much amplification is needed in order to deliver a positive response for the patient. So on this graph, speech intelligibility index is at the bottom and this is just a percentile number that is generated in the software. And so if I go back here, sorry for jumping around, right in the middle of the screen, you see this SII in green, or in orange, purple and teal. So those are the numbers that I'm talking about. That's the speech intelligibility index. So what you do is that speech intelligibility index is your percentile down here on the bottom of this graph.

So let's say that you achieved a 38% speech intelligibility index. So you'd go up from 38 and you would say, okay, on an NU6 word list, we would expect that patient to achieve about a 50% understanding. And in sentences, we would expect that patient to achieve 95%. So when running speech, because of the redundancy in speech, we would expect that person to achieve 95% audibility or understanding as long as they

have a normal, you know, neurological system on speech understanding. So at the end of the day, small changes in SII can yield huge benefits for your patients. So in the example of was that first good enough for that patient that I gave at the very beginning of this talk, you know, at first fit, for a soft input, the patient achieved 29% speech intelligibility index.

So on cent, or on words, that patient would, we would expect that patient to get about, eh, 35% of words correctly. But with 38, we expect them to get 50% of words correct. In sentences we moved them from 85% to, by making appropriate adjustments to that fitting, we moved them from an 85% speech understanding and sentences to a, you know, 95%. So small changes in SII yield big benefits for your patients. I would highly encourage you to read this ask the expert on SII. There's also lots of materials on AudiologyOnline on SII. This is an invaluable tool for your practice and one that I use often in my counseling with patients that I'll, you know, I'll go over with them how, you know, these changes that we're making to the hearing aid, how they're aiding their ability to understand speech, 'cause at the end of the day, that's their goal.

So I asked kind of what is the best hearing aid? I already gave away the answer for this. The best hearing aid is the one that they're gonna wear. And so we need to make sure that we're doing amplification that they can wear and tolerate, but also achieves audibility that they're looking for. All right, so what additional features can we do with real ear? So I went over the unaided aided protocol. You can also open up live speech as well. And on live speech with Inventis, you can do multiple input levels, just like we talked about before, or you can open it up to have a lot of other sounds in here. So you can actually open up to live speech or the microphones on your system are out open and active.

This is phenomenal when you have the husband and wife team where the wife is a low talker, the wife that talks like this, and then the patient that clearly has a significant

hearing loss and then you wonder why you can't, why they can't hear each other. So you can open up live speech and you can have the wife talk and explain to the wife like look, you're gonna have to do more. Like, we need to have you use a little bit more breath support when talking because the hearing aids alone are not gonna be able to be good enough to amplify your voice. We need to have you kick it up a notch, right? So I use live speech all the time to make, to counsel patients on hey, here's how he's hearing you when you're talking.

There's also, Inventis has done a really nice job of adding in a lot of other sounds and tones as well. One of my favorite is bird chirp and I'll walk you through an example of how I used this. I had a patient who was a bird identifier. This was his job where he took people on tours and would go into the tropics and he prided himself on his ability to identify birds, but he had a significant high frequency hearing loss and he was really struggling when he would go on these tours to be able to identify birds at distance. So we hooked his hearing aids up, and yes, he had audibility, but I was able to use the bird chirp in the live speech segment of the Inventis software to say, oh, you know what?

You don't have audibility at 60 DB with your hearing aids. So this was the teal, was pre adjustment. And I'm like, you're right. You know, that high bird chirp at 4K, we're missing. So we made some adjustments to his hearing aids, and the second run, which is the gold, shows that yes, now we have audibility for that bird chirp. So you can use the Inventis software to help manipulate a specific use case for that patient too. This is what sets you apart from the guy down the street, right? That you're taking that time to really understand what's most important to that patient and then using your software, using your tools to adjust those hearing aids and look into that.

There's another feature that I would encourage you if you have the Inventis Trumpet system to look at. It's the distance from fit, so it's over on the right hand side where

you can toggle this on and off. I'll usually do all of my adjustments and then I'll tell my patient, okay, now I'm gonna look at my report card. And so distance to fit will highlight an area that you're very much underfitting. And so what I do is I do all my manipulations and for me, I would've turned up that high frequencies from six to eight a little bit more on this particular patient and then I show distance to fit and it shows I'm a bit under target here at six, you know, 6 to 8K.

So I could go back in and make some adjustments for that patient. One of the other methods or ways that I use real ear is for locked hearing aids. So in the United States, we have a number of companies that are still doing locked hearing aids and so like Beltone or Miracle Ear where I don't have the software to be able to make adjustments to those. But I could still evaluate 'em and see where they're at and see if there's, you know, if they're underfitting or overfitting. You can also use this for over-the-counter hearing aids that you're not directly manipulating or adjusting, but you can show the patient, yeah, this is doing well, or you know what, this isn't cutting it, like, your hearing loss has exceeded the capabilities of that instrument.

And you can use your verification software for that. We're running close on time, we've got a couple minutes left so I just have a couple more things I wanna impart to you. You know, I'm often asked, is verification a fitting tool or a selling tool? And it's both for me. Absolutely I'm using it to fitting to verify that my patients are achieving the audibility so they can achieve that benefit and satisfaction I'm looking for. But also it's a selling tool for patients who maybe have older technology, if they came in with hearing aids that are over four years old, we'll hook 'em up to verification and say, hey, yeah, your hearing aids are not cutting it anymore and here's what we could achieve with newer technology.

So it can absolutely be both. For me, inclusion of verification had some tremendous impact on business metrics. So our conversion rate for new patients is extremely high.

We're in the 90, you know, percentile for our help rate for new patients. You could also impact your conversion rate for patients with older technology, like I mentioned, hooking up their old hearing aids and trying to assess whether they're beneficial or not. It can also impact your business by having reduced number of return visits and reduction in return for credit. If patients believe the technology that you've put on them and they believe in you as the professional, your return for credit rate will absolutely be less as well. So with all of that, I'm gonna look over here at the questions again.

How can we use verification for fitting hearing aids for Meniere's disease? Great question. You know, when you have a fluctuating hearing loss, what I tend to do is I'll set up multiple programs in the hearing aid. So I try to get an assessment of kind of what are, what's their hearing like on their good day, what's their hearing like on their really bad day, and what's their hearing like on their average day. And then I'll set the hearing aid for three different days and then I'll verify at each one of those to make sure that we're achieving the audibility level that we need to. How can you use this for patients tolerance of their own voice?

The occlusion effect is real, people. And so patients do have tolerance issues for their own voice. One trick I have for evaluating occlusion is the first thing I'll do is I'll put the hearing aids in and I'll mute the hearing aids and have the patient continue to talk. If the patient tells me that the occlusion that their perception of their voice is the same, whether their hearing aids are off or on, that's not amplification occlusion, that's a physical occlusion. So we need to do something about the plumbing on that hearing aid, whether it's opening up a vent, stepping back if it's an in the ear product, if you kind of cut back the vent opening, sometimes that will help with physical occlusion.

If it's amplification occlusion, then we start to can use your verification equipment to make manipulations to the software and verify what manipulations you're making. Oftentimes, occlusion is reported if you're over amplified at their resonant frequency.

So where their peak is when you do your probe mic unaided response, if you're over amplifying in that area, they'll report it as occlusion. So if you do have a patient that's really having some voice tolerance issues, I would highly encourage you to do an unaided response, look at what their, what their amplitude of their resonant pitch is, and then adjust your hearing aid appropriately. We are over time. Thank you guys so much for the great questions and I really appreciate, appreciate all of your responses and your attention.

I'll leave you with this quote, "The world hates change, but it's the only thing that's brought progress." So this was an entrepreneur in the United States, Charles Kettering who spent several years at DELCO and GM. And yes, it's hard to have to integrate new things into your clinical practice, but I guarantee you it will be in progress for you, for your patients, and for your clinic. And my information is right there. If you have any questions, feel free to email me and I can get you in touch with the right person at Inventis too.

- Sure. Fantastic.

- Thanks.

- Thank you very much Elizabeth and I truly hope you all enjoyed this fantastic learning opportunity with Dr. Thompson. So real ear measurements are an excellent initial reference point for you and your clients to start a journey of better hearing. Real ear should not be viewed as being overly technically difficult. It's not that hard. And remember that verification achieves more than correct gain and output. So I really hope Elizabeth can make herself available for future events we would organize. And it would be a great pleasure for us and then Elizabeth to have you as speaker.

- Thank you guys so much.

- So last note, my note, my last note, you will receive soon a survey. I humbly ask you to fill out. The survey will help us to understand your needs and your suggestion. Thank you Elizabeth once again and thank you all. Bye for now.

- Bye-bye.