Integrating Real Ear Protocols into Daily Practice

Presenter: Steve Hallenbeck

Thank you very much and welcome, everybody, to today's session. So, I'm sure you've been reading the instructions for the course for a little while now. So hopefully you've got all of this, these details buttoned up and all the information at hand. And so it is my job now to welcome you to this talk, which I will begin with an apology. Sorry so much.

The title of today's talk is integrating real air protocols into your daily practice, and it's based off of some prior information that was part of a presentation that went by this name, getting real ear with fitting protocols. So, I don't know, maybe I've mellowed in my age here or something like that. And I decided not to use the teenage New York version of today's presentation of getting real air with fitting protocols. However, the theme and the topics will be quite similar. So I hope you're all ready to go on this journey with me today for our learning outcomes.

So here's a couple of things. Is as a result of the activity today, you, the participants in the phone call, will be able to describe why real ear is an integral part of the fitting process. I'd like to have you, or rather, you will be able to explain how to choose hearing aids and options that appropriately balance comfort, intelligibility, sound quality, and occlusion. You'll be able to discuss how to apply software and hardware changes to hearing aids in order to match target. And last, but certainly not least, you'll be able to describe how target matching can influence other factors of a successful fitting.

So things look back to available gain, sound quality, comfort zone, and so forth. So all of these things together will be what we'll cover over the next hour. So sit back, relax. Usually these presentations kind of begin a little bit with a questionnaire about, you know, do you verify and. Or do you not verify or how do you verify or so and so forth.

And I think just to kind of lay some things out today, there's, there's a few things I if you want to send comments and say, yes, I'm a hearing aid verification champion. I do

this all the time, please shout it out, share it with your friends. I am a giant proponent of it. I would always hang my hand on these things and think that it is truly an integral part of the hearing aid fitting process. Something super important.

I do recognize that there are reasons why we can't do it. I think for that reason, this is not necessarily a presentation to say, like, you have to do it all the time, or I'm not trying to shame anybody who doesn't do it or think that there's a better or different way to go about it, but hopefully, if you're not doing it yet, by the end of this, there'll be a few things that can help give you a little bit more enthusiasm and interest in it. Another disclaimer about the course is that this is not a very technical course. This is not a class that sort of speaks to, like, all of the nitty gritties and getting every last half of a DB to line up against target and things like that. It's kind of a little bit more general, a little bit more how do you take it, and how do you put it into a practice that's both efficient and then inspiring for patient care and patient outcomes?

I do like to think about how verification can be used as part of a fitting experience. You know, something to kind of elevate the profession and even have a little bit of interactivity when we work with patients and describe things to them. Let's see, I'm getting a shout out right now in the q and a, so this is fantastic. They say we do real ear measurements for every fitting as part of our protocol, so that's fantastic. I'm super excited to hear that.

And hopefully, if you want to add in any more shout outs, I'm always up for it. I think if you want to add in some things, some color to that statement and anybody else who wants to speak to some unique ways of fitting it in, before we get into why it's important, I will also, I want to share a story from my past and kind of thinking a little bit about how it can be used differently and how it can be used to engage patients. You remember, it's a visible screen, a visible representation of sound. So it's a multimodal way for patients to learn how hearing aids work. I had a patient with Meniere's disease

once, and this was right in the advent of using apps and stuff like that to be able to adjust hearing aids.

And we sat down and plotted her audiogram and then went back and did a measurement and then showed how, in one of her points of fluctuation, how we could use the different eqs on her own to give her more or less low frequency or high frequency amplification. She was able to see it on the screen, and she became a very active user of amp apps to be able to meet her fluctuations with Meniere's disease on a daily basis. So I think that's just a little catchphrase and it was inspired by this comment that came through about how we can use it in some different ways. At any rate, I will go off on tangents throughout the entire course today, so I will try to get back on track here and hopefully be able to give some good details, as well as inspire you with some ways to do things a little bit different. So why verification is so important?

First of all, I'm going to kind of blow through some of this stuff a little bit quick because I think I'm hoping that some of you have some of this in your back pocket already. This first line here to account for individual ear canal variations. Remember, when hearing aids are built and developed, they are tested, and there's a term called homologation to make sure that they meet all the standards and they come out. And these are done using the IEC coupler or two CC couplers and things like that. And as we know, another little good bullet point from the past was the original couplers that were used for testing hearing aids were the two CC is not all that representative of a true ear canal.

It was more or less a known volume that was on hand that could be used to begin to standardize and make the process of building hearing aids homogenized from one device to the next. Accounting for individual ear canal variations is a super real thing, and an important part of why it's important this is this part about actual instrument performance can be ensured to the pre calculation approximation. This is a super

science y way of saying what you see on the screen is likely not what's going to be happening in the ear. You have to do these tests in order to make sure that these things get lined up, the goals of audibility based on a prescriptive fitting algorithm can be realized. So, for both audibility and patient acceptance.

So this one kind of relates to quiz question number one, if you're keeping track here. So which of the following is true about first fit algorithms? You know, they oftentimes require some kind of verification in order to ensure that the programming is optimal and these goals are being met. Right. It provides this objective guidance for fine tuning rather than guessing.

Yeah, we all have quite a different vocabulary that we use to describe sound quality. It's a really, really hard thing to kind of have language, to have an objective concept of what somebody is talking to. I remember once in the past, somebody came in and they were describing, you know, I have a hard time hearing a background noise. And it wasn't until I put it into a test box, because this person was a little bit remote. This is pre Covid.

And, you know, man, this, this peak was like right around one k and there was absolutely zero high pitches. You could do this, that and the other thing and million different things. And without seeing it, you know, you can just cut right to the chase and do so much with verification that when trying to do it with just verbal exchanges, becomes so, so difficult. All right, this also too, kind of ties into quiz question one a bit. But just to walk you through this is, you know, there's a, there's a few things is maybe this is another good question to get some shout outs about, is this, is this difference between Nal NL two?

So this is what we would consider to be a generic fitting rule. And the first fit really aided response for five premium hearing aids. So, and this is measured at 55, 65.

So the idea here is you've got your red line across. This would be zero. This would be. If the. If all the lines lined up across this red line, there would be absolutely no variation in measured performance versus what the computer thinks that it's going to do.

And across all manufacturers, you can see there's always a little bit of difference. Hopefully. I'm going to actually bring up a pointer here just to make sure that you can see my mouse as I'm talking. So you see, there's a lot of discrepancy. Sometimes up to as much as 14 or 15 decibels in the highs here.

And then sometimes some overshooting in the lows over here for 65 and then a decent bit of overshooting. And we've got some closer matches to target here, maybe about seven decibels or so away. A criteria that's often used for, um, matching is instead of trying to get it like, so that it lines up with this exact zero line, is to try to get it within a tolerance of around five decibels or so. Some people might be even more stringent to try to get into a three decibels difference. Some people might be a little bit looser and go get down to seven decibels.

So, you know, you definitely have some outliers here that will, um, you know, kind of influence the goal of that fitting with being able to, to give some high frequency audibility across the board. If you just hit the first fit button and don't do the real or measurements to then apply more gain to move these up. And that's, you know, again, without, I think there's two pieces of this is that Nal NL two is of course, a device or brand agnostic fitting formula. So they can say, you know, this is the best audibility, you know, in these laboratory conditions and so and so forth. Then through receiver characteristics, microphone characteristics, how the chip processes, input, dynamic range, all these different variables.

Then the manufacturer has to go through and balance these things in order to get, you know, good perceived sound quality, thinking about comfort for the first fit, acceptance rates, things like that all factor in here. And so that's a. Because of those reasons, the first fit oftentimes has these initial discrepancies. So that's another reason why we should be verifying. So that if somebody says, you know, I don't really think I'm getting a whole lot out of this hearing aid, and you look and you verify and you see this discrepancy, then you know why and you can do something in order to, you know, actualize this and allow patients to get more out of their hearing aids than they originally thought and do more and be better.

Here's another one that goes into quiz question number two a little bit with what techniques are available to improve patient satisfaction throughout positive hearing healthcare experiences? They are usually realized between patients and hcps. When real ear measurements are used, we see things like increased acceptance and adoption of hearing aids, increased perceived value in the products and services, more likely to repurchase, and then as well, even an element of a willingness to be able to pay more for service and experience. So verification, and in the question too, I mentioned a little bit about validation is, I think the other part, there's a course that I've given here in the past about going for the goal and lining up cozy goals along with this to kind of get your whole holistic approach to hearing care. And I would definitely recommend looking at that to get your two bookends, your subjective and your objective.

Today we're kind of focusing a little bit more on the objective measurements. Other reasons why it's important and other benefits is that it's been seen over the years that almost about two and a half visits with both verification and validation, and then you can maybe expect an extra visit in there. And I mean, I think it, not to belabor the point here, but it is about efficiency, you know, measuring, looking, saying, here's the problem, let's fix it, instead of trying to talk our way through it, are some of the main

keys behind that. So save one more follow up visit through using these things, the REM system itself and the reason why I popped this in here, not just to kind of update the presentation a bit, but also, oh, I'm terribly sorry. These costs are in euros and I don't know the exact.

What's the word? I'm looking for exchange rate at the moment, but I would say if you swap that with a dollar sign, you're probably not that far off from thinking of it in terms of us dollars. Maybe the cost of a Realtor system is closer to six grand, something like that. Six k these days, maybe 500, something like that. But however, the point of this is that as you begin to break it down in terms of the number of fittings per week and the number of weeks that you're working in, a year, clearly a european slide, when it says 49, sorry.

And then it should say 52, then you have the $4.50, so to speak, per hearing aid fitting here.

At any rate, the idea is oftentimes when people say, I'm unable to use REM measurements, it could be because I work in a hospital system and my budgets are constrained and I don't have the ability to pay for these things. This goes even beyond the private practitioner. Who's that? Maybe their side of it is, am I able to keep the lights on and so on and so forth. So I think, you know, tools and techniques to begin to justify the cost, like this can be good to begin to kind of, you know, just, again, whatever practice setting you find yourself in, hopefully some of these things, if you do have barriers along the way, you can use some of this information to begin accounting for it and thinking about how you can use this on a.

And how you can justify it to anyone else, any other stakeholders in your business. All right, a theme for today, and this is one of the updates with it as well, since we're talking about efficiency and doing this, because this is the other thing, is it's about

time. And that's that slide previously where it says you can, you actually might be able to wind up saving one extra appointment. So maybe that's a half hour appointment is. We have a tool built into the software, and a lot of manufacturers have these as well.

We call ours target match, but we have a way of a workflow for doing a manual REM, which includes data entry into the fitting software, data entry into the REM system, running the measurements, and then doing some manual fine tuning, in our case in phonak target, and then with the automated system, you put it into one and there's this automatic target match that just makes it a little bit easier. So planting that seed now we're going to swing back around to target match as we move throughout the presentation this important or this initial section was just to, again, kind of hopefully reiterate about the importance of doing it, why it's an integral part of it, why some of the barriers exist. If you recognize that, then, you know, you can reflect on these things after the course. And then there are some items such as automated REM target match out there that can help improve your fitting flow and make it so that it's a nice, efficient way to get through it. Okay, change of focus.

Change of topic here. So this is about integrating real measures into your practice. And I like this. I like this topic a lot because this is the type of thing, too, that I deal with on a very regular basis in my own business and my own working affairs is a lot of times folks will get phone calls and these will land on my desk as an audiology manager as I'll begin troubleshooting these more difficult cases and things like that. And we'll get questions that are all about why isn't the hearing aid matching target at frequency x, Y or Z and things like that.

And in short, the number one is that's the entire reason behind it. So, giving a little bit of backstory, I think that the question that customers will come to me, audiologists, hearing care professionals, that they'll, they'll say when they're calling me is, I've done all these things and it still doesn't line up. And, you know, sometimes there's an

element of, you know, there are outliers. These things are based upon averages. These things are, you know, individual characteristics that we can't always go in and see, there is a realization that it doesn't always line up to be, you know, you know, absolutely precise, DB by db by db.

But if we can look at this and, and the reason why I'm putting this into a presentation here is to kind of, you know, codify some of the steps and demystify some of these things. And if you're on the call right now and thinking, every time I fit a hearing instrument x, y or z, this part of the frequency region seems a little wonky or something like that could be any one of these different things. So I wanted to begin with this concept of choosing a hearing aid with a focus on audibility. So this is about setting the hearing aid up for success across the board. So the first place that I want to begin with is spitting ranges.

And again, this, this one definitely is. I think it's a place where, as hearing care professionals, we often start is that we look at somebody and we see their audiogram and we've decided that as a group and we've talked to the patients, they're like, hey, you know, you need a hearing instrument. And let me look at these fitting ranges in order to determine what's the best one for you. And, you know, you plot the audiogram within these gray shaded areas. And if they're all, if all the thresholds fall within the gray shaded areas, then you're good to go, no problems, right.

And that needs to be adjusted just a little bit. I would always say that the next step, if they are somewhere and have about ten or 15 decibels of headroom from this highest line here, these highest thresholds, and then here, this one tracing along this side, and then further on down the road, if you have ten or 15 decibels of headroom between the highest threshold and this cutoff, then I think you're probably okay. But you want to put it as you're getting closer and closer to that level, ten to 15 deep head relative to this highest line, you're going to want to plug them into the fitting software, kind of go

through a simulated fitting and think about the dome that you're going to use, and think about some of those things up front with occlusion. Think about sound recovered too, and frequency compression. How are those going to influence what you see relative to the fitting range?

Fitting ranges in general are usually, assume a closed fitting. And they usually assume, I believe, the proprietary algorithms, sometimes with pediatric fittings and stuff like that, you might see them using more like DSL or NaL NL two being used, because that's typically what they'll be fitting. But otherwise, we have a tendency to fit with our own proprietary algorithms for those reasons that we can design it the way that we want to for the sound experience. It knows the hardware takes all of that into account on the front end. So these aren't just simply done to be it.

Well, let's give them zero gain hearing instruments, because what's normal to them is what they like. It's just a comfortable shoe. Fit it that way. No, there's actually design considerations that are taken into these things. However, if the person here is saying, you know, we do real measurements on for every fitting, the thing is, is to take a look at that and consider what's the fitting rule that I'm using?

And might that influence matching target on the front end of it? Let's see, there is a question that's come through here. If in any clinic REm is not available, then what is the best protocol for verification and validation of a hearing aid? That's a great question. I think that for the verification part of it, I don't know that I have an answer to it because verifying, you could argue there's things like functional gain that could be used as a, you know, objective way of measuring.

It's kind of more of a behavioral verification leans a little bit closer to a validation side. And then there's all these things that go into functional gain with like when you play a tone, is it amplifying that so much that it's actually kind of over amplifying it and

making it look not quite right? So there's some things like that. I don't know if it's. Maybe it's the best.

I'm not entirely sure. I don't have a. Any kind of evidence or claim to back up what might be the actual best for that one. The validation part can be done, obviously, even without the real or measurement piece of it. I'm a big fan of cozy, and then I'm also a big fan of the hearing handicap inventories pre and post fitting to be able to go through and make sure that we're getting some subjective validation.

But that's kind of a slightly different talk.

At any rate though, so fitting ranges as a place to start, they're a good place to eyeball it, but then to kind of go to the next step to integrate it even further, we do a short simulation, especially if you're starting to get close to those ten or 15 decibels of headroom limits up in the high end there. Here's a good visual example for you. Here's an S receiver. We see some of these things all the time here where you've got the receiver coming through and it's being just outside of the normal range. And then what you will notice is that usually the limits of the device take away anything about an estimated feedback pathway or anything like that.

Is that even just the limits of the device? This gray area, the targets are going above that. So that's a good way to just remember to keep an eye on that and make sure that it doesn't wind up being anything significant. Right. All right.

Coupling best practices when it comes to hearing instruments. So I think this is the other thing. When somebody comes in and says, I'm not matching target at a given frequency or a given frequency range a lot of times. And this is hard because I often can't see this within the fitting file that comes to me, or it looks off base, straight away

in the target fitting software. And again, every manufacturer does this a little bit differently.

So I encourage you to go in and take a peek to see how your preferred manufacturer does it. At Phonak, what we do, when you change this in the fitting software, it will actually change the, literally the output characteristics of the hearing instruments. You can change this as I go around and give talks, and I love coming out and doing student talks because we'll use this device called a clang finder where you can listen to it. And by selecting these different domes, you all automatically will hear a shift in sort of the resonant frequency and the way that just the overall sound quality sounds. So if this isn't lined up and then back to the pictures earlier with the fitting ranges, we are assuming a closed fitting with those fitting ranges.

So if you use open domes, then kind of all fitting, all, all bets are off with that fitting range. So really this, you know, I think this is probably the biggest culprit right here. So with open domes, I would be very mindful about looking at the audiogram relative to the fitting range in this three to 6 khz range. So in those higher pitches, focus on that with those. The vented dome right away is kind of a, in the middle here.

Not too occluding like the power dome, not too open like the cap or the open domes. It's kind of that Goldilocks version of fitting receiver in the ear, hearing aids and a great place to start. You get a little bit more, you know, moderate to severe with, in the upper frequency regions, just by including a little bit more, granted, you know, again, ear canal dynamics that can change person to person, slit leaks that might be a little bit harder to manage. So then if matching target is key there, then you're back into the power dome range. Another question came up relative to would soundfield be helpful in lieu of Rem?

I think the way the question is worded here, I think that's fair. Would soundfield be helpful in lieu of Rem? Yes, I think it would be helpful. I don't know that I would say. Would soundfuel be a replacement in lieu of remote?

I don't know that I would feel that the same way about that, but helpful to kind of begin giving you something a bit more objective for verification, I would say. Yes, that's probably a good way of phrasing it.

Let's see here. Power domes, I think that's where we left off. Power domes are going to, because of the double flange nature of all of this, you're going to have better chances of getting some good seals around the ear canal in order to seal things up and provide some high frequency gain. But it is still, you know, a relatively flimsy piece of, you know, rubberized plastic. So even for this one, it's like, yeah, you know, you're going to be able to fit more high frequency targets, match more high frequency targets, but you're still going to be a bit of.

A bit of a loss here. When we're talking about, you know, really kind of sealing up the ear canal, the seashell, this is going to be the most occluding. I put it on this side for that reason. I don't want to make it sound like a seashell or a custom ear mold is uncomfortable because it's custom. Sometimes these can even be the most comfortable options.

However, you know, if it breaks, then you have to go in for a repair and so on and so forth. So I'm not. I don't know that I would highlight seashells for all, but, you know, these are going to give you if. If target is the key, it's something to really consider going for slim tips, the acrylic and the silicone. These can also to kind of just help steal the ear and maybe do a little bit better job than our dome options for patients.

So some things to consider. So, again, kind of walking back, this is about. This is less about doing real ear, but answering the questions of when they don't. When you don't match target. What's the story here?

So before we even start tweaking or coming into anything else within the real air software, I think I want an extra animation here to. Nope. I can say I'm missing a dome here. So we should have a vented dome in the middle. But you need to strike that balance.

Right. For the person who commented earlier on where we do real measurements for every fitting as part of our protocol is if you are held to account because of that, you know, for a third party payer, or maybe it's part of like a KPI for the. For the office itself, then you have to, you know, definitely be thinking about, like, okay, well, what are. How am I including the ear canal then, taking into account what's the person's comfort with the amount of occlusion that's in there? Is there something about the sound quality or the feedback that influences all of these choices?

And then how is target and speech outcomes being worked into this mix here? So I hope that you're noticing on this screen, the part of this that I hope is apparent to you is that the balance is achieved by this plus this plus this plus target and speech outcome. So that's the, in my opinion, kind of the best balance for a good high quality fitting. It's not a clue or it's not coupling type personal occlusion. Plus taking into account sound quality equals a target match.

I think they all are part of a continuum that you need to continuously balance in order to have a good, successful fitting. Okay, so for some order of operations here. So again, the, the idea of making real air an integral part of your clinical practice is to say, all right, it's important. We know it's important for the reasons that we talked about early on. Sometimes people will see the targets don't match.

And that's okay. That's the whole reason why you're doing it, because there are things that we can't account for on a manufacturing side.

The steps that I just went through, all those different key features. Features are the things that I would say you need to have aligned and accounted for even before you start going in and doing a real air measurement. So the order of operations is make your best choice for the receiver and dome. We didn't even really talk about power levels, but that's one of the reasons. You have your s size, you have your m size, you have your p size, and then you have your ultra power, which is usually part of the.

The seashells. So the, the thing is, think about what's the power level that you're choosing. I'll give you a personal example. I'm just in the process of fitting my dad in the not too distant future. And I'm looking in the past, he had m receivers and I've gotten those now.

And his hearing has changed a little bit. I'm looking at it, I'm thinking, oh, it's probably time to move him up to a p receiver and get just a little bit of extra headroom out of that. So a trip to the office, for sure. So take a look at these things. Make your best choice for receivers based on power and domes.

I mean, it is, it's trial and error. There's no way to kind of know this just without getting your hands dirty and getting in there and try it. There's no, not really too much magic. You can look at the frequency levels and make your choice based on that, but at the end of the day, you got to just give it a try. I would set my adaptation or my acclimatization management to 100%.

You know, to make sure, and that's 100% of target, to make sure that you are going to be able to match target ultimately, if that's the goal. And again, I'm supporting this as

part of the, as part of best practices. Run the feedback tests and then check your results. All right, so here, this space between this blue line and the purple line up here, this is what we call headroom. This is awesome headroom.

If you see this with every one of your fittings, you are the maven. This is fantastic. This is not awesome headroom, because here your amount of available gain is kind of coming right up and bumping up against this kind of gain for soft sounds and stuff. So you're, you're kind of, you don't have a lot of headroom before you're able to, before you're hitting some, some gaps. And we're going to talk about a way to work around that in a moment.

And then if you see something like this, this is the time to consider a different kind of acoustic coupling because here your purple line is beginning to cut off. I mean, look at this. This is around like 1500 hertz. You got a lot of high frequency intelligibility that's coming up in this frequency region that you're sacrificing. And by changing the dome or the acoustic coupling, you can come up quite a bit.

And again, there's also some things that we can do called over tuning that can help us account for this digitally. Because, again, that whole, that whole concept was that it's that balance. You might put a power dome on it, you might put a seashell on it, and somebody then says a few words and their voice is so in a barrel and they just can't get used to it, then that is a reasonable, why you might have to fit an open dome on somebody with a loss like this. And it's, you know, in those cases, you guys have to count counsel appropriately, you know, document. And then this is the part where hearing care is not transactional.

It requires you to follow up over time in order to have them come back after they've acclimated to having things in their ear, after they've learned how to hear that sounds differently, they need to come back and have some changes to go along with that. So

this is not a transactional thing. You go through these steps, then I would say it's time to complete the real air verification. All right, let's take a minute and talk about this guy over tuning this feature overtuning. And why is it there?

We go. So what if you don't? What if you still don't like what you see? That is, you're not matching target. Then what if the patient still doesn't like what they hear?

So maybe if it's due to occlusion or something like that. Of course, there's some give and take with all this, and we're going to talk about some of that stuff in the not too distant future. Here's the story with over tuning. And again, in the interest of time, I'm going to kind of go through these a little bit quickly. This is an older screen cap of the target fitting software, but it still is pretty relevant to this talk.

This is one of these scenarios that I'm describing here where we did a feedback and real ear test. And this is sort of the estimated ear canal characteristics that for where feedback might occur and where we might introduce some things with gain limiting and things like that in order to not let feedback come in and causes to be a problem. So you can see this is really not an ideal, this is not an optimal fitting. Your overtuning control is down here and by turning this up, you're able to introduce some available headroom. So as you start to add steps to it, it will turn on whistleblock.

So it's going to be on automatically after you start to do it because it's taking the phase canceling system and overriding it a bit so that we get more and more headroom. And here in this right side relative to the left side, you can see that even the gain curves begin to pop up and get into this region now that you've over tuned right. And excuse me, you can do that to the point you can go up. So we did 17 steps of over tuning here in order to reach that target. And you can measure the output of the hearing instrument and then match gain.

So these are some tools and techniques that are available, again, to kind of take the, to make sure that you're set up for success through the, through the settings of the hearing instrument before you get to the time when you're going to run your real ear measures. Okay, so a word to the wise here is make sure that you evaluate the sound quality and the gain and make sure you get, if there's any feedback tendency at each step, you know, by kind of bringing your hand up to the ear and stuff like that. This can be done via remote support. It can be easily increased and decreased if needed. So if you turn it up and it starts to sound strange to a patient, all you have to do is turn it back down and so you can.

There's a lot of play and experiential things that can come over this. And then it gives you this full control and flexibility and security for both you and then all the patients. So make sure that you run your feedback test to best echo. Cancel the experience for own voice pickup. That's for the hearing aid with the phone.

So again, this is a bit of a plug. At Phonak, we definitely advocate for running the feedback and real ear tests on every patient that comes in. It's just a good step to counteract many of those different things. Last one, and I thought maybe this was in the slide, maybe it's elsewhere. Don't forget that as you see those things come back around and take a look at the acoustic coupling.

Digital solutions are just that. They're digital solutions. The physics of the ear canal, the way that the coupling and domes work is really super important. So let's see. I think moving on to the next thing.

Let's get past this a little bit. I don't think we need to spend too much more time on over tuning. Ah, this is it here. Overtune is going to reset and disable after recalculation, changing the receiver power level, doing a different test, creating a new fitting. This is a disclaimer.

You know, we're super conservative over here. If you've got, like, a severe to profound hearing loss and they're wearing the hearing aids and streaming 24 hours a day and stuff like that, and you've got over tuning cranked all the way up. Yeah, sure, maybe you'll get a little bit more battery consumption, but this, in my opinion, is not a reasonable. Not to use the feedback over tuning. You see all these things, too, about changing the receiver and power level.

If sound quality. If a patient comes back and says, this doesn't sound right, there's something kind of weird. That's that idea of that previous example that I showed you was done using an M receiver. We've got other power levels that can go up and provide the gain that you need without having to use over tuning. Right.

So again, it's a puzzle. It's. It's putting all these things together and it's using all the tools that are available to you. So from a real perspective and, and how it makes this an integral part of your fitting is to. Oops, I'm sorry.

I have kind of a double, some exercise that were added in there.

So the idea is that making it an integral part of your fitting, it's not just, oh, I've got this equipment now. It's going to work fine. Take the time to go back and review the steps that I just went through quickly and briefly for you, because doing those things will set you up for success with our technology so that you can get. So that you can make it an integral part of it. Some people might be looking at this and saying, boy, you know, I've.

I got real ear and I started using it for about a week or two and it added probably extra visits because I was trying to, you know, figure out how to use it. And I spent a lot of

time doing real ear troubleshooting in order to. And it. And it took up all my time. So, like everything, you know, the practice of audiology is just that.

It is a practice and you need to get good at it and you need to get really muscle memory, like I'm trying to. What's the word? I'm automatic with using these things to be able to get in there and do it super quickly and efficiently. All right, so now let's switch gears a little bit from setting up for success. I think maybe the one last caveat on that is I've taken the time to walk you through all the different steps.

I'm very confident that with every other manufacturer out there that you have to go through similar steps. Maybe they're not exactly the same, but I've yet to see an experience where manufacturer X, y or Z doesn't have the same types of setup things in order to get you to this goal. Right, so this is a little bit, really 101. What are you looking for? What's good and what's the type of thing that's going to give patients success with your technology?

This screen right here can be kind of a lot to take in if you're looking at real ear measurements for the first time. This is a screen cap that comes from the Natus oracle. And this is, you've got, you know, kind of a dashed line here, light blue, dashed line, solid blue dash line. Those two go together. You've got your dark blue, you've got your dark, your dark blue ash line.

You've got your purple line up here. And you've got kind of an NPo measurement up top. You've got your UCLs up here, got your thresholds. This gray area, anything below this is part of the dotted line. And so I think there's just a few things.

Let me see if I break this down. I think. Yes, here we go. So if we break that into individual bits, I believe, don't have this. We'll see if I'm going to.

Might paint me out to be a liar in a moment. I think that this is a aided response for a 65 decibels input level. It might be a 50 decibels input level, but the reason why I'm showing this to you is to kind of take that picture that you just saw, that was everything all at once, and then breaking it down piece by piece. And then we can begin to use this for some troubleshooting techniques in the long run. All right, so this hash Line is your target.

So I believe as well that this is an NAL NL two target. And an interesting thing to consider is that some of these high frequency targets, awful awesome. Often fall beneath the audibility region. Right. So it does beg the question of, are we trying to do something to chase these things?

So here, if you've got this target down here and you tried to bring it up and get a spot on match, you know, I'm not sure that that's. That you're going to be able to do anything. The difference here, I'm just kind of eyeballing it. We're saying this is 80, this is 70. So this difference is probably the target ought to be somewhere around, I don't know, let's say 76, 77.

And the actual measurement is maybe around 71. So this might be a little bit beyond the criteria here. So this might be right at five decibels difference. Right at. Maybe it's a four or five, maybe it's six at the most.

But that might trigger someone to say, like, oh, I have to, you know, match this target up. In general, if I see this, I'm saying, good work, I'm done here. This is. This looks lovely. Let's move on to the next, because let's not forget about this area here that's shaded.

That's the LTAs, the long term average speech spectrum. And you'll notice that even though the target is below, some of the speech energy does come up and begin to get

into the audible range here. So as I'm looking at this, I'm starting to rethink again. I think this is actually a 55 decibels input level. But at any rate, the point is that the numbers, a lot of times we just want the numbers to line up.

But remember to go back and look at the bigger picture. Let's see what else. Oh, yeah. So we might chase this area. But again, the point of that was just to discuss how the LTAs gets into it all right.

So for your real ear measurements, techniques for those of you that are joining to learn a little bit more about real ear measurement itself, usually the step by step includes putting the probe tube in and measuring an unaided gain. It depends on if you want to do insertion gain or not. Maybe if you're just doing real ear aided responses, um, that's less important for you. But you can do your probe tube placement also, too, to make sure that you're getting some, that you've got a good open tube, you've got it placed correctly, then you need to place the hearing aid on top of it. You need to make your baseline measure, counsel adjust, remeasure.

You do this as a loop a couple of times, and then you come back around and move on to the next steps of the fitting. What might those next steps be? That's hearing aid orientation, that's aligning goals, that's getting some subjective feedback in the office, and all of these. We'll talk for a few minutes. Hopefully, time permitting, will be able to discuss where these steps might want to, might need to fall in the process of hearing care.

This is probably one of the biggest areas of probe microphone troubleshooting. Right? So, and I think some of the places when I work with students where there's the biggest amount of apprehension, right. So the ear canal size and shape can vary. We've all heard of the phrase, if not, there's your fun at Friday night parties for you.

But the bump and jump method of doing probe tube measurements, where, you know, you're placing the probe tube, it gets right up against the eardrum, and then the patient begins to wince. This is the types of things, I think, as audiologists, we are that group of people also in the healthcare side of things, where do no harm is at the core of what we do, right. And so anytime that we bump the eardrum, we're very conscientious of that. If you've ever had it done. I've had it.

My eardrum is like, done. It's just, it's, you know, it's been worked already. You could put truck through my eardrum practically, and, I don't know, pain response to it. But for people who are getting this for the first time, it's like, oof, that is not a fun feeling. So it can be challenging to get that in, but if it's not in the right place, you can really get a lot of high frequency variability, and you'll be chasing highs, and it won't make any difference.

So back to troubleshooting. Is if this part's not done right, man, it's building a house on sand there. Then on the hearing aid side of it can be challenging to place while keeping the probe location consistent. A lot of people do this. I'm relatively okay with it.

When you put it through the vent, however, the vent characteristics can change. So if you're really fine tuned on the low frequency energy, keep that in mind as that can impact some of the various frequency regions. But that does help take away some of the variability with them. All right, so we've covered probe tube placements, we've covered hearing aid placement. And then you saw a baseline measurement earlier on.

So now some of the things are to consider counseling and or your adjustments to do the loop again. So again, I'm not gonna, this is, this is less and less about like actual, you know, what levers you pull and that kind of thing, but just kind of an overview of it. And so for these next thing, I'm going to segment the really response into low frequencies below 250, up to about 1000 hz. We'll look at mid frequency things that

arise somewhere between one k and three k and then things in the higher frequencies like three k up. And remember, with a lot of hearing aids out there, even with the extended bandwidth these days, the effective frequency region still kind of get, get up there in such a way that, you know, you're not getting a lot of really usable amplification or information above 6000 hz or in that six to eight k region.

All right, so we talked a little bit about venting gain and low frequency compensation when we talked about the coupling and Dom considerations. So your very first pro tip when thinking about troubleshooting is this is what we see all the time when we get questions coming in is, are the acoustic properties in the hearing aid and do they match the actual setup? So what I mean by that is do you have a vented dome attached, but you have an open dome in the fitting software. If you don't, you're going to see some pops. Usually it's in the low frequencies sometimes because that ear canal resonance will change.

You'll see some variation in the mid frequency regions around one k. So here's, here's kind of an example here where this was a measurement taken on the ear and that exact issue was what was being shown there. So shifting over to a power dome and now you see you've got a better low frequency target match and then even the highs kind of popped up over here. So always a good and important thing to check that make sure that you're confirming the presence or absence of any middle ear pathologies. Boy, we are cranking time wise here.

Let's see. Did the tube get plugged up with wax? A lot of times I see dips like this in that scenario. So again, kind of removing and replacing a tube, and then you and I didn't even have to make any kind of changes to the hearing aid gain whatsoever. So I think there's some things associated with that.

And then last but not least is can I reach my target with the hearing aid receiver and output? And in this case, recalibrate? Make sure that you can over tune, you can fine tune, you can reposition the tube. And in these cases, this one was achieved simply just through some gain adjustments in order to get that up there. However, you've got a lot of different things.

This might be just basic verification in and of itself. You know, that difference between the manufacturer setting and fine tuning to match target can account for that kind of change. Right. Right then and there. Okay.

I would like to kind of blow through that real quick. You have the slides on these? Let me just make sure that there isn't any kind of quiz question completing the ReM. Of course, hopefully you've seen this so far. Is that.

And we talked about this a little bit beforehand, is the quality of the fitting will improve the emotional response? Sometimes patients, because they've got high frequency audibility, they can walk out the door and have better conversations. And then, of course, our professional skill level goes up. So that's a little bit of the detail behind that one. I think all of those are pretty important, and we definitely talked through question number four, how those all work together and when targets are not matched in the high frequency regions.

Oh, which is a good first troubleshooting technique. So this gets back to making sure that the gain isn't being limited in the highs due to that feedback calibration. So we talked to, with respect to overtuning. So just if that wasn't clear before, I wanted to make sure that that was covered with respect to the quiz questions. We have just about five minutes left.

And instead of the long story short here with the case study was essentially this. This was a colleague that I work with. He brought her mom in, and these were the. He brought his mom in. Excuse me.

These were the initial rems that I measured. There was a discussion that on the right side, it was a little bit harder. He noticed that if people were on the right side, that it was a little harder for somebody to hear. It was a little harder for her to hear. Excuse me, my mind's going faster than my mouth and all this.

Apologies for that. So right then and there, somebody says, I don't hear so well from one side versus the other. Without verification, what do you do? Is it to just start turning the gain up straight away? So here you can clearly see again, you verified that complaint and now you have some technical things to go through.

The checklist is this that we went through the domes, everything looked perfect. All that stuff that I said prior, we had already covered that, that this is what I was saying, that the right ear sort of low two positioning was fine. Left ear just required a little bit of gain adjustments a few minutes later and I was able to balance out the sound quality in both ears. So making it an integral part of the process should oftentimes be that easy. And you want to get your muscle memory down to be able to go through these things very, very quickly.

All right, fine tuning. I want to just talk about target match one and two. Target match is a means by which you can automatically adjust the gain settings, get to that end goal at the push of a button. It's really all about precision. Here you can see again any deviation from this zero line is just a difference.

And first fit with gray target match is. I'm sorry. First fit is with Nal nl two. The green is with target match. So there's bear in mind here that each one of these, if five decibels,

is your criteria for the most part, other than right up in this region, you're going to, you've already matched your criteria that most people use.

However, you can get a little bit closer to that precision type fitting with target match. And again, for making it easy and efficient, you can do it without having to go in and press each button individually. So it's a time saver. It improves accuracy. Oftentimes that kind of stuff is worth its weight in gold just because it's one less variable that you need to remember.

We recently rolled out target match two, and the improvements here is it's compatible with more real ear measurement systems. Target match one is still the version that is with the natus oracle. Excuse me. You don't have to do anything. The software will know which one to use to connect it to.

With our updates, we've made some things that were mandatory in a pet in the past. We've made those optional now and changed the workflow just a little bit in order to, again, make it easy and more efficient so that that way you can move through the process a little bit faster so we can talk more later on if you want to send me any emails about that and I can give you some detail. So feedback and Realtor test is, I'm sorry, target match rather is found in the global tuning screen with our latest updates. You actually have the ability to go through and try target match if you open up a training mode and a trained patient. So the way that you do that is here in our settings.

All right, it looks like the questions have quieted down. So the last thing that I wanted to close with today was just thinking about where to put your real ear measurements in the process. So some people will ensure the physical fit, go through all the steps we talked about, verify counsel and move on with orientation in the verified settings. This just gives you the backstory. Maybe you didn't actually adjust to match target, but

knowing where they are helps you predict performance in the coming weeks and months.

This is a fine way to go about doing it depending on your personality. If you're less interested in having the discussions early on about really making everything match up where you ensure the physical fits, you match the target and then you counsel. These can be difficult conversations because you might be having to say, the patient might say, this sounds very strange to me, this sounds unnatural. And you have to have and you have to build that narrative that says you will adapt to it, you will acclimatize to it over time. Again, if that's your personality, then this is probably the workflow for you.

And then last but not least, a lot of times I see folks ensuring the physical fit, setting them to the first fit, going them, having them go home for a few weeks and then verifying after they've already adjusted to it and get some acclimatization. Now, I'm not, I don't have any evidence to suggest that one of these methods is better than the other. However, in the context of doing verification, in order to make sure that it becomes an integral part of your process is it's important to go through and consider your process right now what your personality is and which one of those most appropriately fits with your, with your fitting concept. All right, we are at time. We are 1 minute over.

In fact, I had also prepared. Sometimes I go through stuff faster, sometimes I go through it slower. I had prepared some slides about verifying for cross and verifying for remote microphones. These are in the slides that you will get as, as part of attending the class today. So you can feel free to go through and review those at your own leisure.

But today these are key messages for cross. Let's, let's get through here. And I just want to kind of come through and recap a little bit here. So we talked about why the

number one thing is to know what's happening in the ear canal. This is hugely important.

The how part about it is, again, hopefully the theme that came across here was to consider your pre verification steps. Running the process of running real ear verification usually goes by very, very quickly when you have all of these things set up and accounted for. And then I gave you just a little bit of a taste at the end of considering when and where this should fit into your fitting process. And we've got some tools. We didn't talk much about verification assistant but specifically with target match.

So I will hang out for a few more minutes here if there are any other questions that show up. But otherwise, I thank you very much for your time and attention to today's session.