What's the Hype About Wideband Tympanometry?

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- Welcome to today's course, What's the Hype about Wideband Tympanometry? presented by Laura Prigge and Tony Lombardo. It has been said that innovation is seeing what everybody has seen and thinking what nobody has thought. This month on AudiologyOnline, we're celebrating innovation in the hearing industry with our second Industry Innovation Summit. Thank you for joining today. And we hope to see you in other summit courses, which you will find in our course library. We would like to thank our title sponsor Care Credit, and all the companies who are participating in this year's summit. And now it's my pleasure to turn over the microphone to Laura and Tony. Thank you.

- Thank you everyone for attending today's AudiologyOnline webinar. My name is Laura Prigge, I am one of the audiologists with Grason Staler and today, I am joined by Tony Lombarda, who is another one of the audiologists with Grason Staler. And we're gonna spend the next little bit talking about what's the hype about Wideband Tympanometry. Before we dive in, we'd just like to give a little shout out to the audiology team at Grason Stadler. You can see that my picture is over there on the bottom left, and Tony's picture is on the bottom right. And in the middle is our other audiologist and product manager, Karen Morris.

And if you've looked at any of our resources that are on our website or any of the other AudiologyOnline courses through Grason Stadler, you probably have recognized one or more of us from some of those things. But yeah, we do spend a lot of time doing recordings and videos and training, so be sure to check out our website for any other information that you need. Tony, I'd like to kick it over to you to start us off.

- Thank you. And thank you for attending today. We're excited to be here. So, here are our learner outcomes for today. So after this course, participants will be able to list two ways that standard Tympanometry and Wideband Tympanometry are the same. And after this course, participants will be able to list two ways that standard Tympanometry

and Wideband Tympanometry are different. And after this course, participants will be able to list three advantages of using Wideband Tympanometry as a regular clinical test. All right, so like Laura said, we definitely want to give a shout out to our resources page on our website. We have spent a lot of time and effort gathering as much relevant product information about our stuff as possible.

And we do have a lot of plans coming up here for additional assets. So, definitely keep checking in on our education page. It's a great resource. So for today, here is our agenda. We're gonna do just a brief overview of the new TympStar Pro Version 2. We will be doing a review of basic Tympanometry since we're gonna be talking about Wideband Tympanometry, we thought we'd start with the basics and then we'll review Multi-Hz. There are some similarities between Multi-Hz and Widebands, so we'll discuss those. And then we'll get into Wideband and talk a little bit about testing with it, show you guys what the UI looks like, and hopefully get you excited about it. Go ahead.

- So what we're gonna do first is we're actually just gonna start off with an overview or a review of our TympStar Pro, which is our clinical middle ear analyzer from Grason's Stadler. If you have been hanging around for a while, you will notice that this follows the long legacy of clinical middle ear analyzers from the 33, the TympStar Classic, and now the TympStar Pro. And I think that with every release we have had, that just keeps getting better and better. But the one thing that remains constant is the precise, reliable, and efficient testing that you are able to do with this middle ear analyzer. The nice thing about the newer TympStar is the TympStar Pro, and then the new one coming up is the screen is so easy to use and it is a touch screen.

So you're able to really manipulate your parameters and your different settings that you have as you're doing your testing on that touch screen, as well as the button structure that is similar to the other stuff. We call that operational consistency. We also love the

probe. It is a little different than the older one. It does have some functionality. You can change ears and start and stop tests from that. And then one of the other cool things is you do have the opportunity to pre-program your testing protocols. So you can set up tests per user of the equipment or per patient population of the equipment, but you're able to really sort of hone in on the settings that are needed for different scenarios.

With all of our TympStars, we definitely have the multi frequency and multi-component tympanometry, which just means the probe tones are 226, 678 and 1,000 as well as the YBNG and the BG together components. And then of course we do have several integrated special tests. So as we have alluded to, we are actually getting ready to release the TympStar Pro Version 2. And what you'll notice from these pictures, besides the dot halo around the GSI TympStar Pro Version 2, is that we have, we are now able to add some really new, exciting technology, which is Wideband Tympanometry. So just as a review, version 1 has everything that you need to do your testing. So it has a screening protocol test type. It has diagnostic Tympanometry with all three probe tones and the different components.

We have diagnostic reflex and reflex decay testing as well as the U-Station two function testing, so intact, perforated, and patulous. Also on version one, we have the ARLT, which stands for acoustic reflex latency test. And that is some cool technology. And then also Multi Hz which is the test type that we use to identify resonance frequency. When we move to the version two we'll, you'll notice that there are two things happening on this page. Number one, we have our standard, oh, geez ... We have this standard clinical option. And then we also have, sorry, we have the advanced clinical license, which has everything that the standard license has, but also Wideband Tympanometry and ARLT. And then Tony, I'll kick it over to you for your portion.

- Yeah, and with all versions of the TympStar Pro. So one thing that's gonna be tricky with this is that really, there's gonna be no way for you to tell the difference just by

looking at it if you had the machines off, all three look exactly the same. There'll be a slight difference in the power switch on the version two, but they'll look pretty much the same. And from an accompaniment, we have a couple of different pieces of software that, that go with it. And one of them is called the, the configuration application. And if you're familiar with some of our products, a lot of our products have this type of software, which allows us to set up, like Laura was saying earlier and define our auto sequences in the case of the Tympstar Pro and setting your global defaults for the device.

So this is especially useful if you have a lot of people that are sharing the same piece of equipment, and if it happens also that those different audiologists are specializing in working with different patient populations. So, if you have a pediatric audiologist on staff, they might use the configuration application to set up for protocols that are gonna be more reflective of the population that they're dealing with versus somebody who's more dealing with adults. With the TympStar Pro config app, we're able to define both our protocols, our starting points and our preferences for how all the different test types are set up. We're able to do that. But then we're also able to define the different auto sequences that we have.

Now from the factory, we have included a couple of sequences that follow CPT codes, the system default, and then the ICRD, which is the exact same as the system, but includes decay. And of course with this config app, you can also define your own. So you can define your own protocol that will move from attempt to reflexes, to decay. And you can define all of the parameters there and with this piece of software. So all three of them will still have this, and you'll be able to adjust each of those different devices with that. And then next, we have data management, which is gonna be important for us to be able to move the data off of the devices, into a usable format for both our referring population and our patients.

So with, with the TympStar Pro and a variety of other instruments that we have, we have GSI Suite, which is our custom template building and repository software. And it, like I said, it comes for free with all of our devices. The cool thing about it is the flexibility that you have in building templates. So you can build a template to reflect, like say you're doing a really intense diagnostic battery that includes, you know, a diagnostic, Multi-hz, Wideband, whatever it is, you can build reports that reflect that. And you can also build reports that will be pointed more towards your referral sources. So it's really flexible. The other options that you would have if you're not transferring your data from the device to APC would be a direct print.

There are several compatible printers, and then also print to PDF, which is kind of nice. You just pop a thumb drive into one of the USB ports and set up your preferences towards PDF. And it'll just save this session down to a PDF that you can then remove from the thumb and move to your computer. So, I'm gonna kick it back to Laura. She's gonna take us through a little bit of basic middle ear testing. There's a quiz at the end, I think.

- There is Tony, there is a quiz for sure. So when we talk about Wideband Tympanometry, it was really important that we actually went back for ourselves and for all of you who are here to just sort of do a quick review of what we're testing when we're testing the middle ear. Now, of course, with the TympStar Pro you have enough computing power to test the entire battery. So tympanometry acoustic reflexes, reflex decay, and U-station two function. But the take home message with this middle ear evaluation is of course, it's not a hearing test. It's an objective evaluation that's going to give us data on the mechanic, acoustic properties of the ear. The other good news is because it's objective, the patient really doesn't have to do anything except for maybe sit still and try not to cry.

So again, with that, with the standard battery, we do have all of those different tests together and, and available. But what we really wanna focus on is tympanometry. So tympanometry in the most basic of terms is a graphic representation of ear compliance in relationship to a pressurization of the ear canal. In other words, what we're doing is, we're placing a probe into the ear. We are pressurizing, and then we're measuring. This is going to objectively give us information about the characteristics of the outer and middle ear. And it's really measuring the ease in which energy flows through the system. And that is what we refer to as admittance. Here's a, here's a fun slide that I really enjoy, which is just the different components of impedance or admittance.

So when we're looking at tympanometry, we're looking at three different elements that really contribute to our measurement. The first one is the compliance. Some people call this the springy portion of the ear, and that's gonna be your eardrum, the ligaments, the round window membrane, the muscles, all of those things that are springy. Those are the compliance or the springy portions that help transmit sound through that system. The second things that we're looking at, the second components of impedance are the mass elements. And those are the, the ossicles, they're the bones, the malleus, the incus and stapes. And they definitely contribute to sound transmission through the system. And then the third thing that we evaluate is friction, because when we have a moving machine such as our ossicular chain and the compliant, the ligaments and things, there's going to have some energy loss due to friction.

And so we definitely need to pay attention to that as well when we're talking about diagnostic tympanometry When we're talking about tympanometry just as in, as a basic sense, we're talking about single frequency tympanometry. So the probe tone is the frequency that we are using to evaluate the mechanic function, the acoustic mechanic function of that middle ear. And so I think this graphic is kind of cool, just because it shows all of the things that are involved in the probe when we're actually doing the measurement. And as another basic review, what happens when you do

tymps is this, you have your probe tone and it generates a tone that is 226 hz. You stick that into the ear and get a seal and what happens is, it will do an automatic gain adjustment, or an automatic gain calculation to achieve 85 DBSPL in the ear canal.

And then we put it through a pressure sweep. So when you pressurize the positive 200, the ear drum becomes very stiff, like a wall. And so we're measuring all 85 DBSPL of that probe tone. And then as we do the pressure sweep, we continue to take measurements of the level of that noise in your ear. And it gives us some hints about what's happening. We wanna know how much of that probe tone is left in your ear at different pressure ranges. What we also know is at peak pressure, that is the most efficient pressure for sound transfer. That's where most of that 85 DBSPL probe tone is going to be gone, 'cause it's going through the ear. And that's what gives us that nice peak.

And then when we get to negative 400 again, it's much, your ear drum is like a wall. So we're back to that 85 DBSPL. So again, wall, 85 DBSPL. Pressure sweep, the sound is going through the system. And then we get back to that wall and we get the predictable curve that we expect to see when we do a Tympanogram with a 226 Hz probe tone. Who knew Tympanometry was so cool, right? So the reason that we use 226 Hz is because it is reliable. It is predictable and truly it is the fastest way to confirm normal middle ear function. And by normal, I'm talking about like the Jerger, the Jerger norms, like type A, B and C. So I can have my normal, which we see here in my graphic, or I can have a flat tip tympanogram that is B, I know what that means.

I've gone through the training. Or C, which is the negative pressure. We all know what that normal, even if it's not normal functioning, we know the normal result that we're expecting to get. But why did they choose 226? What was the big, you know, the motivator to make 226, the most standard? Well, the cool thing is they figured out that the adult ear and I'm talking like babies, seven, eight months and older considered

adult ears, their ears are stiffness dominated. And what that means is, the part of the ear, the part of the, remember the components of impedance? The part of the ear that is using, that we are using most to transmit sound is the springy portion.

So the mass and the friction have very little actual effect on the tracings that we get when we're using 226. So we have, again, a very predictable response that we see. Second, the 85 DBSPL, if it was at a much higher frequency, there is a chance that they could elicit a reflex and we don't want that either. So we really had, they really had to find a, a nice passive, I guess we'll say probe tone so that we could get the most information out of the most amount of ears. So also it's really easy to calibrate at 226 Hz, millimoles, milliliters and cubic centimeters are all a one to one ratio. And so we're able to really get some, some cool and consistent measurements across the board.

Now I know that this is a shock to everyone, but there are some limitations of 226 Hz probe tones. And really, we know that it's the fastest way to identify the normal responses, but what happens if it's not normal? What happens if you get some weird responses and you just don't know. So the 226 doesn't give us a lot of diagnostic, differential diagnostic value. So we don't have a lot of things we can rely on or look at when things are not as expected. So we know when we have to have a more critical look at the middle ear components, we need to move to a higher frequency probe tone for more detailed information. So the 678 Hz probe tone is a mid-range probe tone that we have available on the TympStar Pro.

And it has been what I call the go-to probe tone when things are just not adding up. Remember 226 is so great, but let's say you do a, you have a patient come in, you do the history. And they say, "Gosh, my voice is really hollow." And you're like, "Hmm, that's weird." And you do a tymp and it's completely normal. You're like, "Oh, type A, all right." And then you have this weird air bone gap. And then you have like this kind, you know, you think back and maybe it was a little steeper of a gradient than you

thought. The immediate thing would be to go to 678 Hz. So that's probably, I, yeah, I don't know that everybody goes to 678, but it would give us some more diagnostic value because as we increase the frequency of the probe tone, we get more information instead of just the springy portion moving the sound through the system, we have both springy and mass contributing to that sound transmission.

So as you move up in your probe tone frequency, you start to get these notches and they're kind of predictable, but there are also, there are way more variations than your ABC that you get with the 226 Hz probe tone. So 678 has been fantastic historically for a more critical look at the different components of tympanometry. And then of course we have the 1000 Hz probe tone as well. And this has been ideal for evaluating mass dominated middle ear systems. And what that means is, infants who are six months, seven months, four months, I mean, we know that the criteria has changed over the years, but these babies who are right around that 4, 5, 6, 7 month old age, their ears are considered infant ears.

And so they are mass dominated. The ossicles are the things that are moving the sound primarily through the system, especially at low frequencies. And so what happens is when you do a 226, you can get a perfectly beautiful type A tympanogram, look in the ear with your otoscope and see fluid. So it's not, there's not a good match there because the mass dominated. So what we've done, is we've moved that probe tone far away from the, from the mass dominated ear and we get much more reliable results, but it's also kind of tricky because babies are tricky in general and interpretation is a little tricky. We're just kind of trying to look for any sort of peak that fits into the norms that we have, that we have published for us.

So single frequency tympanometry with our flexible probe tones are multi-component tympanometry. Really is, I mean, it really gives us some good information, but again, there are limitations. So let's say you have that baby come in and they're four or five,

six months old. They're on the cusp. You're not sure which they're gonna need, are they gonna need 226? Are they gonna need 1000 Hz? And if you guess wrong, you have to do another tymp. And often that is not the most ideal scenario because babies are squirmy and they cry a lot once they've figured out what's going on. 678 Hz, you guys, there's so much information there, but it is widely underutilized.

I mean, if we were honest and took a poll right now, I wonder how many of us would say, "Oh yes, that is my total go-to probe frequency after I get a weird result." And then, you know, also there's just limited information if the results that you get with your single frequency tympanometry isn't as expected. Tony, you wanna talk a little bit about Multi-Hz?

- Yeah, absolutely. So I remember when I first was wrestling with the concept of Wideband, and it was explained to me that it's a whole bunch of frequencies you can see, a whole bunch of tympanogram at the same time with one tracing. And I'm like, "Well, that sounds like, that sounds like Multi-Hz." 'Cause it's very similar. Of course, with Multi-Hz, what we're looking for is resonant frequency. And Laura just did an excellent job of kind of talking about how the different components add up to energy transfer through the system. And what we're looking at here is where that springy portion and where that mass portion have an equal contribution and where the energy is flowing through the system most effectively.

So with Multi-Hz in, inside the TympStar Pro, what we're doing is, is we're using a click stimulus, which is similar to what we're using for Wideband, where we're putting a bunch of frequencies in at the same time and then we're running that pressure suite. What, when you're running this test and you could, we've had this test as a special test going back several instruments, the nice thing about the TympStar Pro and running it is that it's really just as easy as taking a tympanogram. It might be a little bit of a slower

sweep speed. So they just need to hold still for maybe three or four more seconds, rather than for the generally, what we do for a, a standard tymp.

So you get them to you, you do the tymp, and then you are able to see immediately this, this 226 Hz probe tone. This is the first screen that pops up and it's not gonna be compensated, but you can see right here, it looks like what we're familiar seeing, that 226 tracing. And of course we can break it down into components, but now we have several other tabs that we have, and more information about what this test is delivering. And the point I was talking, saying about the older version is that with TympStar Pro, it's fast, The older version will probably to take you a couple of minutes just to do one ear, because you had to basically manually do it.

Whereas with TympStar Pro, it's just doing it for you. It's calculating everything and giving you way more information, just a ton of information. So let's, so after you get this screen that you can see on the left hand side, there are a bunch of tabs. And one of them is the Delta peak tab, which shows you a different graphic of exactly where, what we were talking about here, where the springy and mass portions combined to give us the most efficient transmission. But below that, then we also have a variety of other tabs that we can do, that we're able to scroll through and take a look at for morphology, which is really actually kind of fun to do.

So let's move to the next slide here. And what you can do is, you pull up one of these empty tymps and you can slide this bar to any particular frequency that you want. But what you can do is, you can just start slowly kind of moving through the tracing. So as you're moving through here, we see we've got basically our 226 tymp. And now we can see as that pressure is sweeping, we can see the effect that it's having on what's happening. And now we're getting closer here to where we would be calling our resonance frequency. Now, the nice thing about this is that, even though the device is going to use the criteria built-in to determine what is resonance frequency based on the

math, we always want to check things out visually and look at the morphology of what we're looking at, just to make sure that in the same way, that if we had our peak selector set on our tympanogram and there's a movement in the tymp way out, and the negative pressure the baby's moving, that tallest peak isn't gonna be the peak that we're interested in.

And the same thing here, sometimes it might pick something that's close and you can go and you can evaluate frequencies right around where that resonance frequency was called. And you can take a look at them and say, "Hey, yeah, this visually makes sense with what I'm seeing from how the device picked that residence frequency." And I've actually seen it where there are clinics that will report not only the, the resonance frequency but the two adjacent frequencies next to it, as kind of like a little range. But then, when we get into Wideband, we are seeing similar type of a display, a similar way that we can move through some of the information, but really it's own only a small portion of it. So, is there anything that you wanted to add on, on Multi-Hz before we move on to Wideband?

- So I know that you have already gathered that I think tympanometry is really cool, but I think that this Multi-Hz is actually amazing and fascinating because what's happening is, I am visually watching as I scroll through these different frequencies and go higher and higher in the probe tone frequency, I'm watching the different components of the middle ear transmit sound through the, through the system. So over here, in 300, like Tony said, this is a pretty much a regular tymp. And then I go to 500 and I'm like, it's a little, whatever. This particular test was chosen as resonance frequency, 600 Hz. And I look at the 600 Hz, and I don't think that that's true because remember, at resonance frequency, the springy and the mass have equal contribution.

And what I expect to see is an actual M or an upside down W, so this doesn't really represent in my knowledge and my experience, actual resonance frequency. So just

like Tony said, I'm gonna move forward and see if there's another probe tone frequency that gives me a little bit more of what I'm expecting. So I go up to 700, I can see there's more notching and that means that the ossicles are now starting to really contribute to this energy transfer or the sound transfer into the system. But right down here at 900, this is the money shot, you guys. This is where resonance frequency from a morphology point of view is for sure. So what you see, is you see this springy portion with the upper deflection and then downward is the mass.

And then upward is the springy. And then downward is that mass again. And then as we continue to move up in those frequency probe tones, you can see that the springy portion, the upward portion is less and less all the way to 2000 where we have basically an inverse or an upside down tympanogram. So it's really, I would say, amazing and super cool to watch the different components of admittance change, sort of who's transmitting sound and who's really helping with that sound transfer. And I think it's cool to get, I mean, you know. Oh gosh, I'm such a nerd. Here we go, we'll just move on.

- And the other that's kind of cool about it, is when you're doing it on the screen, if you're using that slide bar, either the plus or minuses, it's kind of like those flip books that you used to do as a little kid, you can kind of like, just see slow a really slow animation. It's kind of cool.

- Yeah, for real, you guys seriously, nerding out, But you know, and it's really cool I would say also, just because it does have clinical utility, it's again, I don't think it's a go-to test for everyone. I don't think people are utilizing it as much as I would hope I would if I were in clinical practice still, but it's fantastic because right now with this Multi-Hz, and with this resonance frequency, it is ideal for documentation. You can objectively demonstrate that pre and post surgery, there are differences and confirm the success of any surgical procedures for either a fixation or a disarticulation situation

that surgery was successful. And physicians like to see that they did a good job and patients like to see that the physicians did a good job.

So it really has been kind of cool when people are implementing this to, to hear how they're using it. So it really does have some nice clinical utility right now and that's available right now. You have it on your actual TympStar Pro if you have it in Classic and 33. All right, Tony, tell us a little bit about Wideband.

- All right. So here's what we really came here to talk about today. And so, the question, first question is, is why did we add this to the tympanometer? Number one, enhancement requests. So, Laura and I are like, like we described, we're application specialists with GSI, and we take calls on all of our different products. And a lot of the times when we're talking to our colleagues in universities and out in the field in clinics, you name it, they are using our equipment. And oftentimes they'll have things that they notice about it that they're using say, "Hey, you know, I wish we could do this with this or add this." It certainly has been, Wideband has certainly been on, on the radar for audiology for a long time.

So getting it to the point where it can be added to the device, we're really, really quite thrilled that we're finally able to bring it. And a lot of it is due to the fact that we've added these hardware updates that allow this device to do this. This is why the version one is incapable. It really is a, what we call it, considered like a memory hog. It's, it's a very, there's a lot of data, let's say. And now, Wideband, you know, has been about 20, 25 years of research have been, has kind of born this fruit, which is now that it's moving out of that research phase, certainly not finished with that research phase, but into clinical application, that and the improvements in calibration, and like Laura was saying, 226 was traditionally chosen because of the convenience and the ease of calibration.

So now with being able to calibrate more specifically, and at some point we'll probably get into how the Wideband stimulus is calibrated. And that in and of itself is fascinating. We won't spend any time on it today, but it's because of these things that we were finally able to add it. And I really feel like it's gonna be one of those very, very important pieces in our lineup for our product. Why is it so cool? Like I said, it's finally making it's way into our product from research. The, just the unbelievable amount of data that you can get from one pressure sweep is just absolutely amazing. Also, making it more of a clinical utility, the normative data that's been published for Wideband.

A lot of that we've incorporated into the device, which we'll show you in just a minute here. But we've also done some additional, additions of common pathologies. So not necessarily normative data sets for, for these different pathologies, but example tracings to give you a little bit more guidance when you're starting to learn how to do the interpretation for Wideband. So what is it, Laura?

- All right. So what is Wideband Tympanometry? Wideband Tympanometry is a test that assesses the middle ear function, using a click stimulus to capture the middle ear behavior at a wide range of frequencies. And I think that that is a key distinction of Wideband Tympanometry versus traditional single frequency or even Multi-Hz, is we are looking at the behavior of the middle ear system over a range of frequencies. So that's new and different. It is, it's really nice because it does show us some traditional Tympanogram at several different frequencies with a single sweep. So just like on the Multi-Hz that we just talked about, we're going to have, we're going to have all of this data because we're using a click, a Wideband tymp click stimulus, but we're gonna be able to extrapolate some, some discrete frequencies and really be able to evaluate those.

The other thing is, it's looking at absorbance. So it's taking this click and it's looking at these frequencies and it is going to evaluate how that sound is absorbed into the ear system, again, at wide frequency range, and it's really fast and it's really accurate. And it's a really great way to obtain more diagnostic information. Tony developed this great graphic that he's going to describe about what we're actually measuring with Wideband.

- I think the easiest way to visualize it is, is really with a simple illustration like this. Essentially what we're doing is, is we're capping your canal with the probe in the same way we do tympanometry and delivering that Wideband click stimulus also calibrated into your canal during the probe check process. And then basically we're just evaluating. We've got, you know, the light green arrow shows an illustration of the absorbed acoustic energy. So that's gonna obviously change through the pressure sweep, but that is the stuff that's being absorbed through into the system. What we're actually measuring though, is the reflectance, the reflect, what's left over in the ear canal after that click has been presented. So, when you look at a lot of the research, the original research, and you know, even going back just a couple of years ago, if you, you know, get one of these devices and you're gonna start using it and you want to do a little bit of reading on it, you might end up reading a lot about power reflectance or reflectance, and that's the terminology that they used at that time to describe Wideband.

And it makes sense, but also, you know, it also makes sense to view it in the absorbance, from the absorbance lens. And from that view, it is really a lot closer to the way that we're visualizing in the concept that we have in our heads for how tympanometry works. So it's, it's making it a little bit more applicable to the, to the clinic in that it's just, it's not flipping it over and and looking at it in reverse. But when you look at those, those earlier studies, you'll see what looks like these absorbance tracings that we're gonna show you here, but they're just flipped over.

So I found myself, especially as I was reviewing a lot of this material, I would, I would take and clip it and then flip it with the, so I could view upside down just so it would make a little bit more sense to me when I was reading some of those older articles. But that is why you might see a little bit of a difference when you're talking about the overall terminology for Wideband.

- It's really interesting too, Tony, I think that it's, remember in the olden days when we used to call tympanometry impedance testing? I think that we're trying to be super accurate about what we were actually measuring instead of being a little bit more clinically applicable, where we talk about what, you know, what the implications of these measurements are. And I mean, it's even as interesting, I think as the terminology with Contra reflexes. You know, what are you measuring from the probe ear or the stimulus ear? There are lots of ways to look at it, but, you know, there's certainly more widely used and sometimes accepted ways. So, yeah, I think that's a super interesting thing. So we are looking at absorbance, just like we're looking at admittance. So, I think it's kind of fun. But I also think all this tympanometry is the coolest.

- Yeah, oh yeah. Now, when it comes to performing a Wideband test, it's absolutely exactly the same as like we've been saying. It's the same as gathering a tymp the way that you traditionally would, a diagnostic tymp. So you would just select Wideband from our, our list of test types, place the probe in the ear, probe fit ... Well, I mean, just like with any other middle ear test with tympanometry reflexes, the whole gamut, getting a good ear seal and getting a good probe fit is important. And it's just as important for Wideband. And there are actually some things that you can see in the tracing that may give you a hint as to whether or not you had a decent fit or not.

But once you feel like you got a good fit, just press start and the tymp lasts, I think it's, the default setting is gonna be at 50 deca-Pascals. the sweep suite's gonna be 50

deca-Pascal for a second. So it's gonna go, maybe 14, 15 seconds total for the sweep. You can change the sweep speed and speed it up a little bit. Ideally, you wanna give the device a little bit of a slower sweep, but when you're working with kids, auto start, fast sweep speed, get the information and get out. But just in general for the best possible tracing working with your adults, that can sit still for more than 10 seconds using the default sweep speed is what you wanna do.

But what we're ready to test, let's take a look at what that UI is for this test type. And if you've seen a TympStar Pro before with the power on, it looks just like this when you turn it on for the most part, it looks just like our diagnostic tympanometry dialogue. The only real difference is, is that slightly different controls on the bottom. And you've got some tabs along the bottom, which is where we're not used to seeing them. We're used to just seeing them on the left side and those tabs are gonna be for all of the frequencies sees that WideBand is gonna immediately extrapolate from as tympanogram and place those there for you to be able to view and scroll through.

So, one thing that we wanted to highlight here is that little red box, which is the, is the age. And that's gonna be very, very important for determining what norm set is being used. So if you have an infant under six months, you'll wanna click that, it defaults to adult, but this will definitely define on the, this will definitely have an impact on the normative data. And then also on the frequencies that the device is using for the Wideband, for the Wideband tymp. We haven't talked about that yet, but the Wideband tymp is gonna be an average of a bunch of tymps together. And in our settings dialogue here, we have the ability to go in and adjust that range of what we wanna see.

So the bigger the slice, the more that we're adding to the average, et cetera. And then of course, some of our general options, like seeing our normative data peak indicator, our baseline configuration options, that kind of stuff is all gonna be in that settings. So now we've got our patient all set. We've made sure that we've got the proper age

selected or age range selected rather. And then we are gonna go ahead and press start and gather our first tracing.

- So this is pretty exciting, you guys, because once the tracing happens again, like Tony said, it's a click tymp so it takes the same amount of time as a tymp, but when we're done, it's going to populate that tymp tab. And so this starting with a win, I mean, we are starting this interpretation, looking at something that we're familiar with seeing, and if you again, have the baseline on and the normative data on, this is going to look exactly like the tymps that you're used to seeing. It is extrapolated from that, from that Wideband click. But I can look at more. So if I do have that baby who just came in who's, you know, six months old but really little or four months old and really big.

So I don't know what to do, if I should use 1000 Hz or 226, I can actually click on this tab here and get the 1000 Hz probe tone displayed automatically. I only had to take one tracing and please note, I also have my ear canal volume. I have my peak pressure. I have my compliance ratings up there. And for each one of these tympanogram also. So it is, I mean, it's, right now without doing any of the actual absorbance data I'm already winning because I only had to take one tymp and that baby was mad when I was done. So I can go with confidence looking at both the 226 and the 1000 Hz. So did you wanna talk about that too, Tony?

- Yeah, yeah. The only thing I would add here again, is just to emphasize again, that, you know, it is extrapolating these tymps, it's giving us that view and our access in admittance. But again, just like with Multi-Hz, you can select a tab on the left there, an empty tab, and you are able to move through tymps in the same way that you did Multi-Hz. So you have, you know, the ones that we've selected out of the gate, the 678,000 have all proven to have clinical utility.

And they're the frequencies that we're used to seeing, but by all means, you can go in and you can look at the way that the morphology is changing over time for all these different frequencies. And you can look at the, the tympanogram for all those different frequencies. I was gonna say, just great place to start with interpretation 'cause again--

- Plus, I'm comfortable with this. I understand this. This is what I've been doing for 25 years. So then the other thing to point out is, you can change the admittance. So you look at the B and the G, you can also notice on the Y axis is really most, so we are measuring exactly what we think we are measuring.

- Oh, I did I say x axis, I'm sorry.

- X, Y, I mean, up and down one. That's what we're talking about.

- Oh gosh.

- So once we have done this click, you know, the click Wideband click tymp, we've checked out our 226, 'cause that's where we feel comfortable. You can also look at the next tab, which is called the WideBand tympanometry average. And what this is, it looks like a traditional tympanogram. I mean, it looks, it looks like a type A, beautiful tymp, but it's actually the average of a range of frequencies. And for adults, it is 375 Hz to 2000 Hz. I should repeat that, 'cause it might be something you wanna know 15 minutes after the webinar. 375 to 200 Hz is the range of the Wideband average tymp for adults. And then for infants, it's a little bit different. But the results here are expressed, instead of millimos, we're looking at actual absorbance.

And so this is a percentage of absorbance across the pressure range. How much of that sound was absorbed through the system? So we're looking at, the Y axis is a little bit different because it is being expressed in absorbance, but it is again, a nice sort of

average for a tymp. This is gonna come in handy and we'll see a couple of examples in a few minutes, but this is gonna come in really handy if you do have a squirmier patient or you have someone who wasn't able to, to complete it appropriately, they talked or sneezed or swallowed or something like that. This Wideband average is going to really add a lot of flexibility and grace, what do you say, it's gonna give you some more, it's gonna give you more flexibility with your patients.

- And then again, the biggest difference between admittance and absorbance is admittance, which is what we look at with a single frequency tympanogram shows how easily the sound is traveling through the system and absorbance shows how much of the acoustic energy is absorbed by the system. And admittance is in millimo's, absorbance is gonna be across the frequency range. So they do look similar and familiar and they are, you know, utilized in conjunction with one another, but they are, they are displaying different values.

- Yeah.

- And then, go ahead, Tony, did you have something else?

- I was just gonna say, and this is just because of the fact that we're not with absorbance, we don't need to compensate because we're not taking into account the effect of the ear canal.

- Absolutely. And then where the really, really cool graph comes in and the newest and I think coolest feature of the Wideband tympanometry is the actual absorbance graph. And what this is, is this is showing us a graph as a function of frequency. So if you look at that X axis, it is our basically, audiogram. Starts off low like a man's voice. Anyway, this is an actual frequency range and we're looking at absorbance. And so it's going to plot how much of the sound was absorbed into the system over a range of frequencies.

And this is displayed at zero deca-pascals at ambient pressure. And you're able to actually scroll through different pressure points to see how that changes.

This is gonna add a lot to our differential diagnosis because we can see, you know, where the different absorbances have been affected with different middle ear issues. The other thing I wanna point out on this particular graphic is the shaded area. So the shaded area is the normative range that we have for adults for the peak pressure. So we're holding, you know, we're displaying the measurement that was at peak pressure and it is the 95th to 90th percentile of normal here in the light shaded. 90 to 10th percentile in the darker shaded and then 10 to fifth percentile in that lighter shading.

And so there are several actual groups of norms that you can, from which you can choose. And then you also have a couple of other options up here, which will come into play in a couple of later slides. Tony, please tell us about this.

- So, the, the one other thing that we added if you look right above where you can access the norms, we also added an option to view it in reflectance. So really, it's just a button that flips it upside down and gives us that inverse. And like I was talking about earlier, a lot of the early publications look at it like this, and there are still a lot of researchers and clinicians that are used to seeing it like this. So being able to flip it is just so that we threw in there at the end so that we can view our results as reflectance or absorbance. And then we also, like Laura was saying, added a variety of different norm sets.

So these norms are, there's a, just a wealth of them all based on age. So we've got infancy, you know, youth and adults. And then, like we were talking about earlier, examples of a lot of common conditions. So we've got tracings that you can superimpose on your, on your collected data to see if it kind of follows into what might be one of these common kind of issues or conditions in the middle layer. The norms

are derived from a couple of studies here, which you can see here on screen and you can, you can grab those from the handout or you can certainly contact us and we'd be happy to provide them for you. So Laura, when should we be using Wideband Tympanometry? I think you know the answer, right?

- I mean, if I was paying attention, I would say it is ideal for every patient. Any patient that I was gonna do traditional tympanometry on would be an ideal candidate for Wideband Tympanometry. I mean, the advantages that we've seen in clinical practice for infants and children, you get multiple tracings with a single sweep and it's fast. So you don't have to flip the coin, or roll the dice on whether or not this baby has infant ears or adult ears when they're right on the cusp, the Wideband average tympanogram like the, the average of all the frequencies really helps to minimize artifact, which we will see a literal example in a second. It's really nice because you can monitor the status of PE tubes and the impact that it's having on, maybe the frequency transfer through the system.

And you know, it's a really great predictor of middle ear status. And so we do get, again, I don't know how many times we can say, a ton of information, but we really are getting a lot of additional information than just that single frequency tympanometry. For youth and adults, it is, you know, if you're doing a tymp, you might as well do Wideband because you do get, again the traditional 226, but you also get that absorbance. And if there is something unexpected, you will have much more diagnostic information for the differential diagnosis. And so you can take the data that you get from the Wideband tympanometry average, the absorbance graph, and add that to your audiometry , your tympanometry and your acoustic emissions for really great differential diagnosis.

And it is really sensitive to multiple middle ear disorders. And I think, again, the take home is, it's the same amount of time to run this as it is traditional tympanometry. So it

really is advantageous. If you look at this particular graph, it is nice because we have, there is research available on all of these different middle, common middle ear disorders and how sensitive the absorbance graph and the Wideband tympanometry is to these. And it does give just another level of confidence when you are reporting, when you are making your recommendations and when you're talking about your diagnosis.

- Yeah, yeah. I mean, and this is not by any means a complete list of where Wideband right now may make, you know, a diagnostic difference for us. And I really think that this is, even though we're talking about a technology that's been around for 25 years and it's just, even though it's now just making it's way into clinical application. And I mean, it has been certainly out there for a little while. There are some people using it clinically, but I think that we're just, we're in its infancy and that this is going to bear a lot of fruit down the road and the research that is going on with this, I think they're gonna find ways to be able to look at this large set of data and give us a lot more information that can, you know, either give us more, better ways of doing differential diagnostics and better ways of evaluating what's happening with the middle ear system.

- And now Tony, it's so exciting because we have like seven minutes left to talk about examples. And I think that we both laughed a little bit because we have not been able to get around to as many people as we would've liked to seen with some of the restrictions that we have. And so we were able to really learn a lot from testing ourselves and the, some of our close from friends and family that we do have contact with. So Tony, tell me about this ... Tell me about this disaster, who is that?

- That's my Tymp, you're welcome. I am just able to create a lot of pressure in my, my ears at will. It's an audiology trick. I'm sure a lot of you know it, but just as an example, I, I did a tracing with significant negative pressure inside of my head to see how it

would look, and I wanted to see how it would look against the example norms. So here was the 226 tracing and the Wideband average tympanogram after I ran the evaluation. All the tymps looked pretty, pretty normal for of the 68 and 678 1000. And then when I pulled it up and you can see the, that line, of course, which is representing the response at ambient pressure, you can see the norms, where it's falling behind.

You can see that unbelievable amount of drop in the lower frequencies. And it really, really becomes apparent and really eye opening and eye popping when I turned on the indicator for where it was at TPP. So at peak. And you can see that dotted line and how much of a difference in, in transmission of low frequency energy, or how much more is absorbed through the system when it's at that atmospheric pressure is amazing.

And then when I put the, the example on it, it followed along really, really well. But again, you know, to be viewed as guidelines, especially the examples that we have in there in, and even for that matter, even normal, normal ears, you will find variations. So it's definitely something where just like with any other piece of information that we have in our audiology battery, we're not just looking at one little thing, we're looking at the whole thing, you know, our audio, all the different tests that we've done.

- When Tony showed me these results I was so, I don't even know what the word is. I was like, excited about that middle picture with the, with the display of the peak pressure absorbance versus just the ambient pressure absorbance, because I thought in my head, "Oh my gosh, what a great visual." I mean, we know how we feel when we have negative pressure, our head feels filled up. It feels like we can't hear quite as good, things are kind of muffled. And when you show the difference between the way sound is transmitted, when you're way at negative peak pressure versus ambient, when you have that type C tympanogram, I just think that's a really cool visual to show parent, to show a physician.

I mean, it really drives home the fact that your middle ear status definitely makes a difference in how you're hearing. So this one is my ear, actually. Tony and I do a ton of testing when we, when we're getting ready to release a product, and we're learning about new test technology. And so you know, we're just testing and testing and testing. And I was almost done with this tracing and my phone rang. And I was like, "Oh my gosh." So I answered the phone and you can see clearly right here around -200 deca-Pascals where I started talking and I was like, "Shoot, well, this is horrible because now I have to do this over." Not that it takes long, I was just, I don't know, you guys, I was frustrated.

So then what I did was I went to the Wideband tympanometry average and look at this, it reduced that noise because we're using an average of all of those different frequencies from 375 to 2000 Hz for adult ears and it averaged out a ton of that noise. And I was like, "Okay, okay." Now that I have not as noisy a tracing, let's take a look at the actual absorbance graph and it looks like my ears were, I mean, I'm right within the norms. So on that whole frequency range, even though I talked, I was able to average out that noise and get some good results.

And again, in my brain I'm like, "Oh my gosh." How many times have you gotten almost through a tymp before that baby realizes what you're doing and screams or cries or wiggles away and now you have to do it again? Which by the way, is way harder the second time than it was the first time, because now they know what's coming. So we were really excited to see this sort of utility with the, with that Wideband average tympanometry and then also of course, the absorbance.

- Yeah. And we weren't able to get a, like Laura said, we were very limited in the, in the numbers of people that we've unfortunately been able to be in contact with, but here is another example. And I think, really think even though we're only covering these three examples here today, they're all, I think very applicable and very common inside of our

practices. So this probe placement one, just the effect of probe placement. Now, we talked about it a little bit earlier on just making sure you're getting a good seal and you can see, like, in this particular tracing, I was just holding the probe tip right up, and I used a size of a tip too big and just kind of held it up against there until I could get a seal.

And finally, it was able to get a trace and I could see the difference in that, having that loose kind of fit versus the proper depth in seal. You can see how it impacts those lower frequencies. And then you can look at the superimposed tracing in the background there, that is an example of a loose fitting probe. And while my tracing kind of follows it a little bit, it's instructive, but not again, right dead on following it along. But that's what you would see with, with that probe placement, that loose fit. If you, I think one of the general rules for, for Wideband is if you notice that left hand tail up, it's definitely probably a probe thing you want to at least run it one more time for, to make sure you getting it replicated.

- Yeah, absolutely. And you know, as Tony just mentioned there is some individual variation, but there is you know, lots of the tympanometry tests that are objective really depend on your placement and your technique of doing the testing. So again, it's just one of those things that we definitely need to be aware of, but also understand that it's a great clinical utility for this new clinical technology that we're having. So as we continue down the road with Wideband, of course, we expect that there will be continued research. We've talked about it three or four times during this presentation, but we also really expect that this is gonna become sort of a standard in clinical practice, because with the same amount of time, you can get a wealth of information that's going to help you, whether the patient is normal, or there is a disorder that you really need to identify and get some differential diagnoses.

This is also a great application for newborn hearing screening. There are some places where there're doing Wideband in conjunction with OES and you know, the middle ear status has a difference on the passes and refers. And then of course, pre and post surgical intervention is another really cool application that we've been seeing with Wideband tympanometry. So now with that, I would, I think we'll have trying to make one more final push for the Wideband. In conclusion. I just think that it, this Wideband technology has being researched, is really cool to look at.

I mean, to read some of those articles has been really fascinating and to see it in real life and to see how it overcomes some of the clinical challenges that we have with traditional tympanometry that we're performing on almost everyone has been really inspiring. So I think that it's a, it's a great time for everybody who's getting the new TympStar Pro Version Two to go to the config app, go to the startup mode and make it be Wideband so that we just don't forget and do Wideband on everyone.

- Yeah and I would, I would echo that. And I would also say, I mean, you can tell how excited we are. I mean, this is, it's been a lot of, really, really, a lot of fun to get to test with Wideband and play around with it a little bit and we could not be more excited about it. And thank you so much for tuning in today. And we look forward to coming back with some case studies and a much more deep dive into it but hopefully you enjoyed today's overview. Thank you.

- Great. So now Tony, what we're gonna do is, we're gonna stop the screen here and we're gonna open it up and look at the questions we. We have, oh, "What is SCD?"

- Oh yeah, superior canal dehiscence. And it is in the semicircular canals when the, the bone kind of gets a thin spot towards the superior part of the canal. And it acts kind of like a second round window. So, you know, it's some tension inside of the auditory system is good. It helps with the transmission of sound. And this is where you get

audiograms that are kind of weird that Laura of was talking about with like 678. You get a weird airborne gap, but there's it, it's showing it's a normal tymp, you know?

And what's happening is, is that that additional outlet or that soft spot acts like another ... So you've got the bones pressing on the, on the round window and then it has that release valve. Now it's got a second release valve. So the tensions kind of come out of the system, which can be surgically repaired, but that's what SCD is.

- Great, and then the next question is, can the version one TympStar be upgraded for Wideband or does it require version two? And the answer is, it does require version two. And the reason is, all of the stuff under the hood, the hardware and the software for version one are not capable of handling that kind of computing power. So you do need the version two.

- Yeah, the original, the TympStar Pro version one, the one that is released and that is out in the field right now was originally released in, I think 2015, was the original release date. So the, the platform is a little bit older and really, I'm not an engineer. I'm not, I don't know anything about it, but in talking to our engineers, they have conveyed to me that it is a lot of data and a lot of crunching. So it it's, unfortunately if we tried to load it on the, the Tympstar Pro version one, we'd have to delete everything else and it still wouldn't work.

- All right, well, if there are no more questions, then we will go ahead and end this webinar. Again, thank you for coming and watch for your evaluation to show up in, in a little bit here.

- Thank you.

- Thanks, everybody.