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**Research QuickTakes Volume 6: Hearing Aid Fitting Toolbox
FAQs on Pre-Fitting, Verification, and Validation
Presenter: Brian Taylor, AuD; H. Gustav Mueller, PhD**

- Hello and welcome to a special edition of Research Quick Takes. I'm Brian Taylor, and with me today, as usual, is our Senior Signia consultant, Dr. Gus Mueller. Welcome, Gus, good to meet you here.

- Hey, hello.

- Now before we tackle our FAQs, I want to remind everybody that in volume six we discussed many important components of the hearing aid fitting toolbox. I think we covered about eight different things. And since we published that, we've had a lot of frequently asked questions. And that's what brought us together here today.

- Exactly. You know, some of the questions were actually in the article themselves, and then some other questions have rolled in. So I think what you've done is compile both. And also, you know, we should mention that this was volume six, but if I'm correct, all of these volumes one through six have all been, are now online for continuing education at Audiology Online, what, under the Signia banner?

- Yeah, you go to the Signia channel at Audiology Online, and you'll find all six volumes of the research quick takes. And it's really important to know before we dive into these FAQs that, maybe it goes without saying, but you'd have to read or watch volume six before you watch this episode with the FAQs.

- Yeah, you wouldn't have to.

- But it make probably, it would make a lot more sense.

- It'd be a lot more meaningful. Yeah, I agree. But we'll try to reference things a little bit so that it would make sense.

- So, should we get it, start with our first topic.

- Let's go.

- All right, so, in the first volume, volume 6.1 I'll say, we talked about monosyllabic word recognition measures. And just to kind of jog your memory, Gus, we talk about the use of the correct presentation level, why it's important to always use the 50 word list, the ordered by difficulty screening, the use of the Thornton-Raffin critical difference chart, along with the Dubno red flag chart, which is part of Linda Thibodaux's sprint. And we also mentioned in there several times that it's important never to use live voice.

- Yeah, the way I tend to remember it is five things you should always do and one thing you should never do. And it got to be a little preachy, but that's sort of the way it turns out.

- It's the nature of some of these kind of things.

- Yeah, exactly.

- All right, so here I have the questions that we've compiled. So I'm gonna go ahead and fire some of these at you, if you're ready.

- I'm ready.

- Okay, so question number one. You recommend conducting word recognition at a level that is higher than what most patients will experience in their everyday lives. Don't we want to know how they're doing in the real world?

- We do, except we really don't have a test that tells you that. And so the people who think maybe that they do word recognition testing at a lower level, we recommend actually being up at a level around 75, 80 dB HL. And there's some different rules relative to using the two K threshold to get you the best spot that you want to be. But you want to give the person as much audibility as possible, looking for the maximum performance. To do it softer, I mean, first of all, you have to step back and say, it's under earphones, monosyllable words in a soundproof room with no noise and no reverberation. So if you're gonna kid yourself that this has anything to do with the real world, it doesn't. So, so just go for it and try to get the maximum score. Don't worry about what the patient is doing in the real world. We have some other tests that can tell you that.

- And we'll probably talk about some of those later. All right, let's go to the second question. Now, in that quick takes, you didn't mention the Maryland CNC test. Is that an acceptable alternative to the NU six?

- Yeah, well certainly the Maryland CNC test has been used a lot in the VA system. And Rich Wilson has done a ton of research on this whole topic. And a lot of his work has been with that particular list. You know, we don't talk about it, first of all, 'cause most all the research that is looking at things like significant differences and those kind of things, it's almost always been done with the Auditec recording. So that was one of the reasons. And I don't even know if the Maryland CNCs are, they're being used commonly or not in the VA. I don't know if you know.

- I think there's a few VA audiologists that use them.

- Okay, so we could only talk about so many tests is sort of the bottom line. And we chose the Auditec recording of the NU six and sort of stuck with that.

- Well, speaking of Auditec, you just mentioned them a second ago, I had another question about speech testing. And here it is, I have the NU six file on my audiometer, but I don't think it's the Auditec recording. Is it okay to use a different recorded version?

- The short answer is no, it's not. For the very reason I just said is all of these, well, let's take the example of we recommend using the ordered by difficulty, where you give the 10 hardest words first. Well, they're the 10 hardest words of the Auditec recording of the NU six. I have no idea, and nobody else does either what the 10 hardest words are for the other recordings, because nobody's done that research. You know, audiometers today, as many of you know, the audiometers come loaded with a word recognition task. And you would think that everybody would come with, it would come with the Auditec recording, but whoever asked this question, I assume they know what they're talking about, and it's a different list. And of course

we have several audiometers that are coming from Europe, and so we don't know what list they may put on.

- So it's probably important to verify with your equipment manufacturer that it's an Auditec recording.

- Exactly, exactly. Yeah, very specifically.

- Right, all right, I got a couple more questions on this topic. When do you recommend using the ordered by difficulty recording?

- Okay, well, that's a good timing, 'cause I just mentioned that. Which is an easy answer, all the time. Because there's nothing to lose. Because you do the first 10, if the patient only misses one, you're done. You know their score's 94% or better, then you do the next 15, which takes you up to 25. If they only miss three, you're done. If they've missed more than three, you do the remaining 25. And the end result is you do 50 words, which is what you would've done in the first place anyway. So you have, there's no loss. There's no downside. It's either gonna make things better. In the original research, I believe they found that about for 25% of their patients, they only had to do 10 words. So those are probably people with normal hearing is my guess. And so you're saving some time.

- No doubt about it. Another ordered by difficulty question. If I'm doing the ordered by difficulty list and the patient only misses two words of the first 25, do I think simply give him a score of 92%, which is 4% for each word wrong?

- Well, that almost seems logical, but it's wrong. And I guess an analogy would be imagine if you were a student in a class and there were 50 questions on a test. And all the other students were scored in percent correct on how many questions they got right, and the instructor just gave you the 25 hardest questions. Would that be fair then to score you the way you scored the people who got all 50? Absolutely not, and so it's the same thing. If you do 25 and they only miss two, you simply mark on your audiogram, or hopefully you have something you can circle, you know that their score is 94% or better. That's all you know. Well, you know it's not 100%, 'cause they missed two. But that's all that matters. Because you don't really care if it's 94 or 96 or 98 or whatever it is. You know, it's because all the easy words are left. And if they only miss two out of the first 25, the probability is they're gonna get all the rest of them correct. And so that's the answer.

- Makes sense to me. Here's a question that I think you'll give us a short answer on, but I'll ask it anyway.

- Are you hoping I give you a short answer?

- No, it's, to you, it's up to you. But I'm just guessing it'll be a short answer. Is there ever a time when using monitored live voice for monosyllabic word testing would be okay?

- Well if you get to the point of whistling pure tones, then you might fit this into your protocol. I can't think of a time. Particularly today with, you know, in the past, somebody will say, well, the words go by so fast, my patients can't think that fast. Well, today it's all automated. The words

go by as fast as you want them to go by. You know, you pause. So if you were to go out on this limb of live voice, consider that you can't use the 10 best, because you don't know the 10 best of your voice. You can't do the dubbed no red flag criteria because it's only good for the NU six. You can't use Thornton and Raffin and critical differences, 'cause that's only been normed with the W-22 and the NU six. And you can't even compare test-retest because your voice changes every time you do the test. So I would say not doing it at all probably is just as good as using live voice.

- Well, I was wrong about that answer.

- Well, I know, I can't help myself.

- I'll just say, I'll give you the answer I was looking for, and the answer would be no. I think it's also probably a good time, Gus, to mention a quote from, I think it's Fred Bess. We talk about it, you mentioned it in the articles volume 6.1. The words are the words, the test is the test.

- Yeah. Now the words are not the test, the test is the test. Meaning that just reading those words is not the test. You have to use the test, the official standardized normed research words, or you can make serious, serious mistakes.

- You might as well not even do anything if you don't do it the right way.

- Yeah, as we talk about in the article, the 50 word lists were never balanced by difficulty. And so if you want to go out and be pretty cavalier on this whole thing, list one A for example, the eight hardest words are in the second half. And so if you were only to do 25 and 25, the patient might get a really good score on the first, on the right ear if you test that first, a bad score on the left, they're gonna have asymmetry of 30%. And some otolaryngologist is gonna order an MRI for that poor guy, simply because somebody didn't do a full list. So there's a lot of rules, and I told you it gets a little preachy, a little preachy. But there you go.

- No, it's important. You gotta do it the right way or not do it at all.

- The words are not the test, the test is the test.

- Thanks for clearing that quote up. I knew I had it wrong, but it was close. All right, that wraps all of our FAQs for volume 6.1. So we'll just move right into volume 6.2. And we're gonna talk about speech and noise testing now. And in that 6.2 volume we talked about why do speech and noise testing. We talked about the difference between an adaptive and a fixed approach. We spent an awful lot of time talking about presentation level, something that you call SIN max validation demonstration, how to use that test in the hearing aid fitting, selection process. And then we talk an awful lot about what we think is the best test in the clinic. And that's the quick-SIN.

- So, but I might qualify best for a variety of reasons. I mean, some researcher might say, well, wait a minute, this test, it's the best because it's the most available, and it's the most familiar. And our thought was sort of trying to lay out to people something that they could start doing Monday morning that was easy to do and they could talk to their colleagues about it.

- Right, clinical audiology.
- Yeah, exactly, exactly.
- All right, and since that's been published, the FAQs have rolled in. And here's the first one. I've always conducted the earphone quick-SIN test at the patient's MCL. Is this okay?
- No, I can't think of one reason to do it at the patient's MCL. The earphone test is almost always, and should be always, is you want to look at how good does it get? What cochlear reserve does this person have if audibility is not an issue? So right away, you know what you have to do is make sure that the signal is as audible as possible, which means you want to be up at a loud level, usually right below their LDL, at a loud but okay level. MCL, particularly with people with downward sloping hearing loss, there's a lot of energy in the low frequencies, and so their MCL will be considerably lower than where you want to be to maximize audibility. In fact, it could be 10, 15 D below. So no, you would never do testing at MCL. I see no value added at all.
- Okay, let's go to the second question, thanks for that. Is it okay to simply do the earphone quick-SIN bilaterally?
- Better than not at all, for sure. You'll know the results of the best ear. And if it's a symmetrical hearing loss, usually the best ear is similar to, you know, they're both fairly similar. On the other hand, there are people that have a fairly sizable asymmetry. I would always recommend doing both ears independently. The quick-SIN, as you might guess from the name, but for those of you who have never done the test, it takes one minute per list. And you would always do two lists, at least two lists, two's probably enough. So what we're talking about is two minutes for the right ear, two minutes for the left ear. Now if you said, gee, I want to do it bilaterally, so I don't have to do both ears, we're talking about saving two minutes. I mean, if two minutes is that critical, I'd be looking for a new job.
- There's probably some other ways you could save two minutes.
- Yeah, I think so. When they start telling the story about their pet cat, just say, you know, I don't like cats. Let's move on to the testing.
- Okay, so.
- Got it.
- That's good to know. Test each ear separately.
- Whenever possible.
- And you'll be fine, okay. This is a good question. I really don't understand how to relate the SNR loss value to the real world. Can you give us some insights on how to do that?
- Yeah, you know, it's gonna depend on, it's gonna depend on the test that you use. There's a test that's become mildly popular called the Matrix test. And one reason that it's popular is I

think it's available in maybe 15, 18 different languages. But I've looked at the norms across all languages, and it's a pretty easy sentence test. And so the norms that you're gonna find for somebody who's normal is gonna be like minus eight. And so even if you have some SNR loss, you have some, you're not normal, you're gonna score, for example, minus two would be a loss, but yet it's minus two SNR, meaning the noise is two dB louder than the speech. Well I don't know how you equate that to the real world. 'Cause I can tell you if if we walked down the street to the Irish bar and it was minus two, we're not gonna be understanding each other. So that particular test doesn't relate very well. Now the quick-SIN on the other hand, I think is relatively close. A normal score about plus two, and you're still considered normal up until about plus five. So that equates pretty well to the real world. So if someone's score is a SNR loss of three dB, then then that means they're starting to have trouble right about at a SNR plus five. And I think that probably agrees. Plus five by the way is a very common listening condition in restaurants and that those studies have been done, so. I think to some extent, I think you can relate it. Certainly it relates in that you know if there's a loss, you can tell the person you're gonna have mild difficulty in background noise, moderate difficulty or severe. And that's true of all the tests. They all have those categorizations.

- And if I could add unlike pure tones or words in quiet, when a person's doing the test, it's relatable to the everyday experience. So I think it makes, just because it's easier for the patient to relate to the test, it's just easier to explain the results.

- Yeah, exactly, because it is like, in fact, a lot of times when you do the quick-SIN, the person will say to you, certainly when you walk in the room, they'll go, oh God, that was just like the party I was at the other night. I mean they relate to it.

- Exactly. Here's another question. I think it's tempting to think that the answer could be one thing and it's probably another. And is the quick-SIN a good test to use when I suspect an auditory processing disorder?

- No is the answer. It was never normed on that. I know of no study that has been particularly designed to look at that, there are, if you're the type who believes in speech tests for auditory processing disorders, there are several speech tests that have been specifically designed for that. Now with that said, it certainly is possible that someone with an auditory processing disorder will score poorly on the quick-SIN. You know, because, first of all, for those of you who have never done the quick-SIN, the babble is not a multi-talker babble. It's a four talker babble. And it's really not a babble because you can pick out meaningful words. And so certainly that tells you right away, that's called informational masking by the way. So we know that somebody maybe with some cognitive decline is going to get a little confused. And you can start pulling, and people will do this, when the signal to noise ratio becomes difficult, they'll start answering words that were part of the background noise rather than the target sentence, and they lose track of what they're supposed to be listening for. And a cognitive decline is a processing disorder, right. So, but I wouldn't use it for that purpose, 'cause I don't know the sensitivity specificity and those kind of rules, and I don't think anybody does, so.

- Right, good, good. Here's a question, we've gotten a couple versions of this question, so let's kind of condense it into one. At one of the places I've worked, we simply added background noise to the NU six list and used this as our speech and noise test, is this okay?

- Boy, there's a lot of answers that are just no. No, no, no and no. You need norms. You can't just dial in a plus five SNR and do the test unless you have published data in front of you of that very word list, that very recording, and norms for different SNRs. And I don't think that exists for, you know, if you take the NU six list or whatever. Now the WIN, the test words in noise test, that is a very good speech and noise test, that it does indeed use monosyllables, and there are norms for that. But that's a standardized test. It's not just you making up a test in the clinic, you actually would get the recording of that particular test.

- And to do that I think is really cumbersome. Because it's a fixed SNR, you wouldn't really be able to do that.

- Right, right.

- Multiple SNRs.

- Exactly.

- It just doesn't make sense.

- No, it would be very cumbersome.

- And that's the beauty of the quick-SIN and other adaptive SNR tests is that you change the signal to noise ratio and that gives you some really meaningful information.

- And again, for those of you who have not done the quick-SIN, the beauty is, from a clinician standpoint, is the SNRs are all pre-recorded. So it isn't like the old days where you have to sit, and you know, I guess, do people still turn dials? I don't know.

- They push buttons.

- They push a button, okay. But you don't have to like turn the noise up five dB then turn the noise up, and then turn the noise up, then turn the noise up, it's all pre-recorded. You just sit back and click when they miss one or click when they get it right. And it scores it automatically too by the way.

- Here's a good question about aided scores. Can the aided bilateral score be worse than the aided unilateral score?

- Say that one more time, can the aided?

- Can the aided bilateral score be worse.

- Be worse, be worse.

- Than the aided?

- Okay, so I thought you were gonna ask if it was gonna be better, 'cause some people think there's a binaural advantage, but probably doing testing in that situation, probably not.

- I didn't ask the question.

- Okay, okay.

- You want me to repeat it?

- No, no, I got it, I got it. So typically you would think on that particular test, particularly if you have speech and noise coming from the same loudspeaker, which is a common way to do it, you wouldn't expect a binaural advantage. You would expect that the binaural bilateral score would be the same as the best ear. That's the typical finding. There is some report however that you can have binaural interference that could actually drive down the bilateral score from the best ear. I don't think that happens very often. But if you were suspicious, I guess you could do each ear separately on aided testing rather than bilaterally. Which is, by the way, in the article, we recommended just doing bilateral testing when you're testing aided. But you could do each ear separately.

- Now this is a question from an audiologist that probably obsesses about percent correct scores. I find it confusing to talk in terms of SNR loss to my patients and also referral sources. Isn't there a way to use percentages to score the quick-SIN?

- Well, two things, first of all, they're right, it is. I mean, you know, you walk up to this patient and go, hey, Frank gotta tell you, you have an SNR loss of six. It means absolutely nothing to Frank. Where if you told the percentage, then they can sort of identify with that. The problem is the way the test, the quick-SIN, is designed, you would, you could still have normal, you could have a normal quick-SIN, which is a SNR loss of three or better, and if you have a SNR loss of three, by the way, your percent correct is 75%. So that doesn't sound very impressive to your patient. Hey congratulations, you got 75% correct. You know, but that's normal. So that's a problem. What you can do, however, 'cause remember you're gonna use two lists, there's five keywords in each list. So you're gonna use two, so that's 10 key words for each SNR. What you could do is what, and I have done and recommend, in that article we recommended it, that you take just a little sheet and you score percent correct for each SNR condition, unaided and aided. So if you go to, let's say the SNR of plus 10, which is one where you always see benefit aided usually, and maybe they only got two of the 10 words right, so they're at 20% unaided. Then when you put the hearing aids on, they get nine out of 10 right, it goes from 20% to 90%. And that's a nice way to use percentages. It's a nice chart to show the patient. And this is not for a fitting standpoint. This is what we recommend as a counseling, shot in the arm to the patient. Before they leave, 'cause you've done all your probe mic stuff, they walked in the door with a speech and noise problem, and you haven't even tested, you know, you've done a little testing with them wearing the hearing aids. So this a lot of times, it works as a nice counseling tool. Do unaided, aided, and then calculate percent for each of the six different SNRs.

- I can tell you when I was in the clinic, what we did when it came to percentages and found it useful is we took, I took the receptionist, we had a couple receptionists and an audiology assistant, three middle-aged women that had normal audiograms, had them do the quick-Sin, took their dB SNR loss score, which was like three or four, converted it to a percentage, and that was sort of what we showed as a comparison.

- For normal.
- Yeah, for normal. And showed that as a frame of reference.
- That would be a way to do it. Yeah, you wouldn't even actually have to say it's 75%. You could just have scaling.
- But it was a handy way. Because you talk about percentages in other areas and then it just kind of flows as part of the conversation. Anyway, that wraps up volume 6.2 on speech and noise testing. I don't see any other questions here. So we're gonna move right into volume 6.3.
- What if somebody wants to call on a question?
- Well we have operators standing by.
- I bet we do.
- Well, you know, you can just ping us, if you know our emails, you can send us, and you know, if it's happening during this recording.
- All right, all right.
- You never know.
- I know, I can hardly wait really.
- You know, we're at a secret location and no one knows where we are, and they can't bother us with any questions today. So let's move right into 6.3. And we're gonna talk about loudness discomfort levels, or what a lot of us call LDLs.
- And a lot of us call, well a lot of, I don't, but a lot of people call them UCLs, which is the same thing by the way.
- Right, UCL, LDL, whatever you want to say. And anyway, if you go to volume 6.3 and you read through it, you'll see that we talked about research showing that manufacturers do not get it right. We have a nice chart or two in there that shows that. We talk about why you can't predict LDL scores from the audiogram. And then we go into a five step approach, frequency specific LDLs, convert to two CC couplers using the retspos, programming the hearing aids using that information, measuring with probe mic the RE-AR 85, and then of course behavioral validation of that response. So that's what volume 6.3 looks at. And here I have some questions for you. Is it okay to do speech LDLs rather than pure tone LDLs?
- I mean it's okay. I have no idea what you'd ever do with the results. The reason you're doing LDLs is to determine where you set the two cc coupler in the fitting software. I mean, where do you set the MPO based on two cc coupler in the fitting software? If I told you that I want you to do the perfect fitting for my mom, and her speech LDL is 90 dB, where are you gonna set the output at three K? How are you gonna convert that speech threshold to all these frequencies? I

mean, when you go in and adjust the output, the MPO, as you know from the fitting software, you shape the output just like you shape gain, and the targets are the person's LDL. And so I don't know what you'd ever do with a speech LDL. I guess if it was 60 dB, you might think the person has hyperacusis, but, you know, that patient you may only see once every 10 years.

- I think it's a great example of a test that we did before we had multi-channel hearing aids and before we had programmable hearing aids that never really went away. It just doesn't make sense to use speech.

- It's still in some standards and some hearing aid dispensing things, it's crazy.

- Yeah, it's not, so use pure tones for LDL testing.

- Pulsed pure tones.

- Pulsed. I've heard from several people that measured LDLs aren't very reliable, patients aren't consistent in their responses.

- Well you do hear that a lot. In fact that's maybe the number one reason why people say they don't do it. That research has been done. So two things, number one, you need to use the correct loudness anchors. Everybody basically recommends the seven point loudness chart of Robin Cox, and I trust many people have it posted on the wall in their test room for the patient to be looking at while you're doing the testing. In the old days, Siemens actually gave away that chart. It was a nice big chart like this. I doubt that there's any still left, but they were there once upon a time. And anyway, you also then have to use the right instructions, and the instructions are what first becomes uncomfortable. And Robin Cox, along with their loudness act, also has those instructions, which you can download from the HARL website from the University of Minnesota, all of these, University of Memphis, Memphis, Memphis, not Minnesota. And you can get this information. So first of all, you have to do the test correctly. And that study's been done. Catherine Palmer for one found that when done correctly, test-retest is 2.5 dB. What's the test-retest for clinical measurements of thresholds, which everybody does everyday? 2.5 dB. So if LDLs are too variable to do the testing, then you better stop doing pure tone thresholds too. 'Cause it's the same.

- I think the key is also the instructions, to make sure you get those right.

- And consistent.

- Yeah, and we talk, we that's mentioned extensively in the quick take.

- And actually we published the instructions and the seven point scale. If nothing else, just go to that particular issue and you can copy them right out of there. They're not copyrighted, and we have 'em as an addendum in there.

- Okay, so let's, here's the third question. Regarding the RE-AR 85 real ear measure, wouldn't it make more sense to use a speech shaped input signal rather than a swept pure tone?

- You know, that does seem logical that people don't really hear swept tones. By the way, for those of you who do not do this test, the RE-AR 85 does use swept tones, they move very frequently through channels, so you don't have the effects of some of the features that could reduce them. There's a reason why we use the swept tone is that we want to create in the clinic what would we consider a worst case scenario. How bad is it going to be? The folks at Voice Tone several years ago did recordings of certain environmental sounds, and found, one of that I particularly remember was a baby crying. They looked at how high they would drive the output. And it's fairly narrow in frequency, it drives the output about to the level that a pure tone would, a swept tone would drive it. So again, we wanted speech, because it crosses over all the channels, the output for speech will probably be 10 dB or so lower than it would be for a swept tone. So I think that's why we use swept tone and not speech, even though speech might seem a bit more realistic.

- Here's another RE-AR 85 question. For your RE-AR 85 measure, you didn't mention in the quick take doing an RECD. Is that not necessary?

- So the RECD can be used for several purposes. One of course is to predict the output in the ear canal, when all you have is coupler measures, you can add the RECD. I think though this question is a different use of the RECD. And that is it's becoming more and more common for people to correct the threshold, the earphone threshold by using a customized RECD. So what you see displayed on your probe mic screen would be the customized output, rather than using average RECDs. I didn't get into that because, well, I don't know why didn't we. I'd just be happy if people did in REA. It's like how far do you want to push it? Well, with adults, it won't make a huge difference. I think standard deviations for adults are only about two and a half dB. So you're not gonna make a huge mistake. And I'd hate for somebody to say, well I'm not gonna do that at all. 'Cause it says you have to do an RECD and I don't know how to do an RECD, so.

- But for children it would be.

- Critical, critical.

- But we're not, you know, none of our quick takes.

- This is all geared towards adults. Different rules for children, absolutely.

- And I think for a RECD, for the coupled dB, the benefit you might get, it's not worth the time to.

- Well you could, yeah.

- I mean, it's arguable.

- One could argue that it is, but for a couple dB maybe not.

- Yeah, well there's other things maybe that take priority. Okay, let's move to the next question. In the research you reported in the article, why do you think that the MPOs from the manufacturers were so low?

- Good question, and just to quickly review, this was some research that we did a few years ago with Elizabeth Stangle and Woo at University of Iowa. And what we looked at is what was the MPO of hearing aids when hearing aid companies, we used their default NL two programming. We didn't fit the targets, we just used their default. And then we looked to see what was the MPO, how high did it go? So, and we had in a sample audiogram going from 40 in the lows down to 70 in the highs. Well you would think that somebody with that audiogram probably has LDLs around 100, 105. So you want to fill up the residual dynamic range. Well, surprisingly, and unfortunately, many of the companies, the MPO was limited at around 80 dB, which means there was a 20 dB gap between the person's LDL and where it was limited, that wasn't being used. So I mean, anytime anything got up to 80 dB, it's not going any louder, that's not good, that's not good. And that was one of the main things reported, which is why we said that hearing care professionals need to go in and program things and get it right. But we also then went backwards and looked at a few different things and found out one of the reasons this was is the hearing aids weren't really programmed to the now. And once you programmed them correctly, then the output went up also and got more up where it was supposed to be.

- Because in one of the examples, one of the companies do do that.

- One of the six companies actually had an MPO running right around 100, 105, right where you'd think it probably should be. But, and then we went back and looked, and sure enough, that was the only company whose onscreen NAL was actually the real NAL.

- Yeah, but I think the bigger point here is if none of that really matters, if you follow the procedures we talk about, because you can set it yourself.

- Yeah, exactly, exactly.

- All right, I think I have one more question on LDLs. And that is if I enter LDLs into the software, the fitting software for the hearing aid, that is, will the software then set the correct MPO?

- That's an excellent question. That's been bounced around for quite a while. First of all, for those of you who are listening, this is something that you could answer yourself in about two or three minutes over lunch. Simply go in and take an audiogram. And just take a flat 50 dB loss. And then program in LDLs of 80-80, 80-80. Then go to the software to see what it set, then put in LDLs of 110, 110, 110, 110, and go to the software where it set. If it didn't change, then you know your manufacturer is ignoring it. It should have changed by about 15 dB because the LDLs changed by 15 dB. So that's an easy test to see if that's true or not. If you find out your manufacturer is ignoring it, well then there's no reason to ever enter LDLs in. But as we talk about in step number two of the five, you don't care anyway because you're gonna go straight to the MPO software portion and program them yourself. Now, if only there was somebody here from Signia, they could tell us how the Signia software works.

- Well, it does, it looks at it and it corrects.

- It does.

- So I checked with the home office, and I am correct in that statement. So you can try it yourself in the Signia software, you'll see that it actually takes it into account and it shows up on the fitting screen.

- Good, good to know. I'd still go and crosscheck it, but that's good. It helps you out, save some time.

- That's it for LDL questions. I don't see any coming in, so. If you're okay with it, Gus.

- Let's move on.

- We're gonna move into volume 6.4, which was pre-fitting self-assessment scales. So we're talking about things like the HHI, the hearing handicap inventory. There's the elderly and the adult version, the AFAB and the COSI. And in addition to talking about those three self-assessment measures, we also talked about some reasons to use pre-fitting assessments, candidacy, counseling, recommendation of different levels of technology and expectations. So those are some of the things we talked about in this volume. All right.

- Got it.

- So question number one. What's an example of how the HHIE is different from the HHIA?

- You know, first I want to add to, you listed three tests, I think the HHIE, the AFAB and the COSI, right. So we've, in fact, I personally have written a chapter about this. There's like about 10, 12 of 'em out there. And so you could say, well gee, why didn't you have this test? Because I don't think anybody's ever gonna do more than three. And so we basically just listed the three most common, but there are other good pre-fitting tests out there. Wanted to get that out there. Now the question is, has to do, the HHIE, as many of you know, is the HHIE, for elderly, which is 65 and older, which I just don't understand how anybody over 65 could be considered elderly.

- I'm with you.

- Well, anyway. 65 and older, 65 and older. Me too. And then there's, and so it's adult under 65. They get the adult version. And the question was, how are they different? We recommend using the 10 item screening because it's been shown to be good enough for clinical use. I think there's two questions. One that immediately comes to mind is for the elderly people over 65, by the way, if the person's over 65 and they're active and doing stuff and all that, give them the adult version, that's okay. The rules aren't that critical. But it has to do with, one of the questions is, do you have trouble at religious services? Hearing the speaker at religious services. And that was eliminated for younger people. And it's like, do you have trouble in movies and theaters? So that's one example, and the other one, do you remember, there's a second one that's similar.

- I think it's a workplace question.

- Assuming that the younger person is still working. But they're pretty much the same and you get very similar results.
- Well you know, there's a revised version too.
- There is.
- That's changed some of the language within each one of the questions, so.
- And that I haven't seen that get any traction yet. That's been out for about three years or so.
- A few years, yeah. But we'll probably start seeing it more and more is my guess. All right, let's move to another question. Is there an advantage of doing the 25 item version of either the HHIE or A?
- I think I just answered that. Probably not in a clinical study. If you were doing a research project then probably you'd use the full blown 25. But really there's been several studies that have compared the two, and the 10 item was really close enough.
- Yeah, I know that Larry Humes, who's done a lot of work around that topic of auditory wellness says the screening version in the clinic works just as well as the longer version.
- He said that, okay.
- I was at a conference where he said that.
- Okay, well, I'll take your word for it.
- Just a couple weeks ago.
- But he typically uses the 25 item in his research.
- But clinically 10. Which makes sense. All right, here's a really interesting question about something relating pre-fit assessment tools to the quick-SIN. And that is, here's the question, should I expect the AFAB scores on the background noise scale to agree with the patient's quick-SIN findings?
- Probably not, I think, and for, the reason is, the way we would normally do the quick-SIN, which I think we talked about, is you want to maximize audibility. So you're gonna do the testing up at just below their LDL in most cases. So now that's that score, that's the problem's difficulty. Now let's move over to the AFAB. And there's questions like when you were at a grocery store, how well could you understand the checkout person or whatever. Well that's not gonna be up, that could be a very soft speech. So, you know, audibility is so important that it's hard to predict what someone does in the real world when you did a clinical test where you maximized audibility, and then they go out into the real world and audibility is not maximized, which is why they came to you to get hearing aids. So if they didn't agree, that wouldn't surprise me. And that's the reason why. Now, if we did our quick-SIN testing, you know, maybe at around 60 dB SPL, then I think it would have a greater likelihood to agree with the real world.

- Yeah, and I don't think agreement is really the word. It's more I think they compliment each other. It gives you more information.
- It's two different things. And how the person reports their problem is real important relative to hearing aid use and success and benefit, really. Because they tend to use their hearing aids more.
- You should write that down, that's another quick guy. That's a quick take right there unto itself.
- It is, it is, interesting area.
- The next question is about the AFAB. And I think it kind of speaks to why a lot of clinicians don't use it. And that is, here's the question. What if the patient skips many of the questions on the AFAB saying that they simply don't apply?
- The AFAB, I like the test and it's, by the way, it's the most popular outcome measure in the world. I think it's been translated to different languages. Harvey Dillon, when he designed the COSI, one of his main reasons for having the COSI, first of all, for those of you who don't know the COSI, it's a blank sheet of paper, okay. And his key thing was relevancy. Because the person picked it, you know, I'm having trouble understanding my granddaughter and that means he probably really has a granddaughter. Where the AFAB, what you'll find is that they're just like, you know, like on the aversiveness scale, one of the questions is the squealing of car tires. Well, people said I haven't heard squealing car tires since I was 18 and peeled out. You younger people go, what the heck does peeled out mean. You know what peeled out is.
- I sure do. But people don't normally hear the screeching of tires, I hope not anyway, 'cause you're in trouble usually. So I mean, so, but anyway, they have to, to score the AFAB, you have to answer at least three out of the six questions for each category. And what Robin Cox herself has recommended is if a patient is having trouble, just talk to them and say, okay, you said that you don't go to grocery stores, your daughter does all your grocery shopping, but where were you where you were talking to somebody and it was noisy? Well, last Sunday after church we went down in the basement and we all had coffee and donuts. Okay, okay, that's good enough. Now tell me how you did when you were having coffee and donuts. So you need, the more that you all can get involved in these tests, Brian likes the word, uses the word knee to knee, which to me is maybe too close. I'm moving right now. Anyway, but the more that you get involved in this and review it with the patient, the more successful the scores are gonna be.
- Yeah, no doubt about it. Okay, we got a couple of questions on the COSI. You mentioned that a minute ago. What if the patient only picks really difficult listening situations for the COSI?
- Encourage them seriously to change. And, you know, the way I would do it is, and this'll happen, the person, they'll say, okay, we need three things, and you're gonna have problem because, okay, well last night I was shooting pool in a bar, and then two nights before that or a week before that, I was at this gigantic party. And you go, wait, wait, wait, wait, wait. Because they have these really, and they're probably things that aren't even gonna happen again very soon. So you just say, you know, Bob, listen, here's what we're gonna do. What do you do

90% of your day? You told me some isolated little cases here. What do you do all the rest of your time? Well, Joe and I go fishing. Do you understand Joe 100%? No, no, I have trouble understanding him. Okay, well let's get that out, so you need to work it. You can't just let them randomly pick items.

- Yeah, 'cause often they'll pick the toughest places.

- Sure of course.

- They want it to fail.

- Well it's what they remember the most, 'cause they were the most embarrassed, and that's why they remember it.

- Yeah, exactly, right, right, good point. One more question about the COSI. What if a person's COSI expectations are unreasonably high?

- To give some background on this question, in the article, we recommend that once, this is pre-fitting, remember, this is the pre-fitting COSI, not the one after the fitting, which we may get to later. So we recommend that you actually have them rate their expectations. Once they list their items, at least three, no more than five, once they rate it, then we have them actually rate how well they think they're going to do. Which gives you a nice counseling tool, which maybe you can use as your advantage later on when they come back and rate how they really did. I mean it's great when you say, you know what, look at this. You hope you would do this good, that's how good you're doing, look how great this is. So anyway, they're rating expectations. And sometimes they're very high, you know, all the time, all the time, all the time, all the time. And you just have to sit, you know, the line I would usually use is, you know, Frank, I don't understand all the time in that listening situation. That's unrealistic. I think you were forgetting how you really did when you had normal hearing. 'Cause that's a very difficult listening situation. Then okay, well I'm gonna move it down to number four rather than number five. It's a counseling technique. And you know, though, right away it tips you off this could be a problem patient, if that's their expectations, it could be a problem.

- Exactly, that's good. Well, that ends volume six. I don't see any more, volume 6.4 on, on the topic. I don't see any more questions, so I'll wrap that one up.

- Okay, sounds good, good topic.

- Okay, we'll move right into 6.5.

- Sure, all right, let's do it.

- So in volume 6.5 we talk about real ear probe mic measures.

- I've heard of that.

- Yep, I believe you have. Recall in, if you haven't seen it, what we talk about in that is two reasons why probe mic measures are necessary. How now targets may not be true targets

depending on the manufacturer. Talk about some individual differences. And we look at some different step-by-step verification procedures. You talk a lot about the speech intelligibility index and the RMS error. And look at what we would call the goodness of the fitting. And then we touch on auto-REM fit.

- I just want to add that one of the things that, on most all of these, that one of the things, the motivations for us doing these eight of these was that a lot of times people do an article and they just talk about something. And then afterwards the clinician says, yeah, but how do I do it? And so one of the things that we have, I think in every one of these articles, is we have a step by step of how to do it. So if we're talking about the HHIE, we show you the HHI form, we show you a scored form, we show you how to score it, we tell you how to interpret it. So that's the same thing here with this probe mic, is most of what we say is, you know, I would hope everybody knows, but then we also do a step by step of how to do it, including what input levels, what order you should use the input levels, which, by the way, in case you missed that, 55, 75 and 65 is the recommended order. A lot of people start with 65, which I believe is a mistake. So anyway, we give you a step by step, how to seat the patient, how to put in the probe, da da da da da. And that's true in all of these.

- Exactly, it's very much how to do things. That was the whole motivation behind it. All right, well here's the first question around real ear measures. This is one that I've heard a lot over the years. And here it is. I've heard that it's best to let the patient use the hearing aids for a couple of weeks and then do probe mic measures when they return for a follow-up visit. Does that make sense?

- Yeah, no, not to me. I get it, I think why that happens, I think is, I think maybe it's like let the patient sort of ease into it. At least what we've heard is that sometimes the first fitting is a little too loud. And I guess it's just an idea of like let him get used to it and then I'll do it correctly. It just doesn't make sense to me. It's like, the analogy I like to use to that is that, you know, if you've ever had a crown fitted, I mean, would you really like it if your dentist said, you know, it doesn't fit and it slides off to the side and it may fall out, but I'm just gonna have you do that for two weeks. And then when you come back I'll fit it correctly. You know, well, why don't you fit it correctly to begin with? So I don't see logic in that. Plus I think you want documentation of what they walked out the door with. I think you want to know that, even if it isn't a fit to target, you want to know how far you're off from target, because it tells you where you need to go. I don't see any advantage of not doing. And well, of course then there's this problem, the person comes back and so it's a crappy fit. You send them out below target, and they come back and go, this is fantastic. You know, well, what do you do then? Well, guess what, I'm gonna change it. And make it more fantastic, is that what you're gonna do? I don't know, I oftentimes I think of that as an excuse for not doing probe mic at all.

- I would agree with that.

- And they hope that there never is a refit. I don't know.

- The second question is one you've already kind of answered, but I'll.

- Yeah, sure.

- Is it okay to just verify for the 65 dB input?

- No, and here's the reason why, is that even though most of these products have a wide dynamic range compression, meaning a low knee point, the way the first fit comes out from all manufacturers, because I've looked at it, is it tends to be relatively linear. So if you go in and fit to average, I will bet you on any product, soft will be underfit. Because it's the same problem we had of linear hearing aids 30, 40 years ago. So, no, you can't just do average. Because there's actually research, Louise Hickson and her group from Australia, about 2014, I think it was, they looked at variables in the fitting of hearing aids and what correlates with hearing aid satisfaction, the only fitting variable that correlated was matched the target for soft. Not average, not loud, soft. So knowing that if you said, I can only get one thing right, to me, logic would be I'm gonna get soft right. So, no, you can't just fit to average.

- Thank you for that. Here's another question that's very common. It's been asked more than once. It seems like most patients prefer less gain than what's called for by the now NL two algorithm. Why is this?

- I hear that all the time. I don't know. If you look at all the research done by Harvey Dillon, Getta Kaiser and their group, when they studied, you know, the NL one was out for about 10 years before the NL two, and they have a really nice paper where they look at all the things they considered in moving from NL one to NL two, one of the things they of course considered was how close the NL one was to preferred gain. And what they found is it was a little hot, the average was a little high by about three dB. And so they then in NL two lowered it by three dB. And according to their data, this would mean that about 60%, should say it's just right, 20% says it's a little loud. 20% says it's a little soft. So why do I hear reports that 70% are saying it's too loud? I don't know. One tip off is, and I'm not saying that anybody forgets to do this, but it's make sure that if you're doing a bilateral fitting, which you usually are, that you click on bilateral in your probe mic equipment, make sure, if it's a new fitting, you click on inexperienced, there's six dB right there. If you don't do those two things, you'll think there's six dB below target when they're really right at target. So that's one thing to consider. Other than that, I don't really know. It should, but I've talked to other, you know, I do a lot of probe mic workshops. And sometimes there's a bunch of people there who are doing probe mic all the time. And you'll hear some people say, I don't find that at all. I send 'em to now target and send them out the door. And then other people say, they're always, I don't know.

- Yeah, I don't know. You still hear that a lot.

- Yeah, yeah, absolutely. Well, just wanted to add to that. We did do some research many years ago when WDRC first came out, we did this with camps. What we did find is there is an acclimatization to loudness over time, but it takes about two months, where people really start sensing the new loudness mapping that they have from their hearing aids. Because initially, the biggest thing that people notice is that soft sounds are too loud. And so when they say it's too loud, I guess one of the things you might say to the patient, okay, I understand it, but tell me this. Are loud sounds too loud, are average sounds too loud, or are soft sounds too loud? And that might give you some feeling of what's going on.

- Maybe it's time to revisit the PAL.

- The good old PAL, profile of aided loudness, one of the best self-assessment scales ever devised. And which died a very slow death. I don't know if it was ever alive.
- Not for very long, it was on life support from the beginning.
- Catherine Palmer and I put that scale together, where people rated their loudness to everyday sounds to 16 different everyday sounds. It was a heck of a test. Still is, it's still there.
- All right, let's go to the next question. Is it true that for all the special features to work, one must select the manufacturer's proprietary algorithm?
- I've heard that.
- So have I.
- Usually from a rep. Whenever I've twisted the arm of a R and D person late at night at a bar, they are reluctant to talk about that. The word is out there. I don't know that it's true. I know in many studies with products, the manufacturers first program to the NL two, so you would think that they would program them to what works the best, I don't know. I mean, if that really concerns you, and you really believe it, what you could do is start off in proprietary, then your now targets are gonna be on your probe mic fitting screen. So then just go, but click on proprietary, then program the hearing aid to the now targets. So you're sort of, in case that is true.
- So you have, on the probe mic screen, you have the real, the verifiable now correct targets, on your laptop, you have the proprietary target.
- I mean, I don't think the hearing aid is smart enough to know that you programmed it to the now.
- Probably not,
- But they're smart. But I don't think they're quite that smart.
- Yeah, that's a good workaround. And at the end of the day, audibility is what matters. More than anything else for those features to work. All right, good. There are charts showing the acceptable speech intelligibility index range for the DSL. Are there charts that do the same thing for the now?
- Yeah, this is obviously a more sophisticated person to even know that those charts exist. Maybe a pediatric audiologist, because those charts were developed at Western University, Marlene Bogato and Susan Scully and others. And so what is available for the DSL, so let me first say that, is a chart where it, you take the average pure tone, the pure tone average I think for five, one, and two, and then they tell you on this chart what would be considered an acceptable good fitting using the DSL. And so there's a mean, and then there's a range. And if, so, if you said, well this person, the average hearing loss is 50 dB, and you go up on the chart, and you said, well, I should be getting a SII of around 72, and then that'd be pretty close to what I'd say it is for a 50 dB loss. And then you'd see the range and it says I can be anywhere

from 66 to 76 and I'll be still a good person. If it's all the way down at 64, I got some work to do. So those charts were available for the DSL. Initially it was for pediatric cases. Then a couple years ago they came back out with similar charts for adults. Now, the now, I haven't seen those charts for the now. But if you think about the research done 10 years ago or so by Earl Johnson and Harvey Dillon, they compared the SII and the DSL, excuse me, that they looked at the SSI for the now and the DSL for five different audiograms. And what they found was if you fit exactly to target, you would end up, in most cases, only a difference of about 2% or so. So I think you could use the adult DSL ones and get a pretty good glimpse of what would be okay. Verifit, and I know many of you're familiar with the Verafit equipment, actually has that, those ranges right in their software. But I bet if you pick the now, they'd probably go away. I don't know for sure. I don't know, do you have John Pumpford's number? We could give him a call.

- We could give him a call.

- John, if you're out there.

- Phone in a friend.

- Call in, John Pumpford would know. I bet they probably go away when you pick the now. 'cause they're really just for the DSL. But it'll give you a good idea.

- Here's another question that's pretty common. Is there really evidence that using probe mic measures to verify fitting algorithms really leads to a better patient benefit and satisfaction?

- Yeah, well, if it didn't.

- Then why would you do it?

- What are we even talking about all these years for? You know, surprisingly though, I mean, first of all, it's common sense that if somebody hears something, you know, I think they might do better than if they don't hear it. But proprietary algorithms roll things up in the highs. All of 'em, all of 'em. But there is indeed good peer reviewed information that shows that that's true. One of 'em, one definitely well designed was a crossover study by Mike Valente that was published in 2018 or 2019. And he clearly showed that word recognition was better, as again, from the audibility standpoint, he showed that on the AFAB it was significantly better. And he showed at the end, this was blinded crossover, so everybody used both types of fittings. And at the end, I want to say 83% pick the now sounds fitting.

- It was a high number.

- I think it was 19 out of 24 or 21, right in that area. So everything leads to yes indeed. It's worth your time to do it. You you could actually go, the big Bose study, Sabin et al, they sent people out with zero dB of gain, and let them program to what worked the best. And as much as I'm against people programming their own hearing aids, in this case, I'm gonna use it in my favor. And that is, they ended up very close to the now. They didn't end up anywhere near a proprietary fit.

- Right, and they've reported benefit and satisfaction. And there's other studies too, Harvey Abrams has a study.
- That was one of the first peer reviewed ones again that came out in favor. I think his was 80% in favor. So the data's out there, yeah.
- Okay, that's good, that's the last question we have for volume 6.5 on the real ear measures. So if you're ready Gus, we'll just move to volume 6.6.
- I'm ready.
- This is a topic that--
- I can hardly wait--
- You've probably known about since 1971. That is--
- wow, '71. That was a good year.
- You might have to go back to some of the research that was done in the early '70s.
- What, does this have something to do with Bazooka Joe Bubblegum?
- It's peeling out.
- Peeling out.
- We're gonna talk about sound field threshold measures. Our friend.
- The nemesis of hearing aid fitting. Actually in '71 I was still doing speech audiometry. So I didn't start doing sound. I didn't start doing functional gain until '76.
- All right, well I was off by five years. Okay, so for sound field measures, functional gain, we're gonna talk about functional gain. This is what we talked about in the quick takes. Reasons why you might want to do aided sound field testing. Some of the downsides of conducting that testing and reliability in something called the 20 dB rule.
- 20 dB rule, yeah, we did talk about that.
- All right, so you're ready for the questions?
- I'm ready, let's go.
- Okay, let's fire away. Question number one, is it okay to simply use the thresholds from the earphone testing for the calculation of functional gain?
- You know, I actually hope there may be somebody listening who has never had to do functional gain. So let me just first explain what functional gain is. So what you do is you set a

person down in a test booth and you deliver pure tones, and you test unaided. And then you test aided, and then you subtract unaided from aided. And that's called functional gain. Now, one component of that would be the aided thresholds, which is a slightly different measure, because you don't have gain now, but you'd have the aided thresholds. And so there was a time before probe mic came out, which was 1984, we started using prescriptive methods about 1976, which was the Berger method and POGO were the first ones. So there was that gap that, that eight year period there, where we had to verify the fitting, but we didn't have probe mic. And so functional gain was the hot thing. It was the only thing. Because all these methods were in gain. You know, they prescribed X amount of gain. You can go back to Lybarger's 1947, of half the threshold list. So anyway, that's how functional gain came about. Now with all that said, the question here is, since you already have earphone thresholds, do you have to waste your time doing sound field thresholds? Can't you just use the earphone thresholds and then do aided testing, I'm guessing.

- Right, exactly, I think that's it.

- Here's the problem, and it's a big problem. And that is many, many sound field systems are not calibrated correctly. And most audiologists, if you walked up to, went to academy meeting and grabbed people as they walked by and said, if you sat, if you put your dial on 50 dB on your audiometer, what's the SPL coming out of your loudspeaker? Very few people are gonna answer that. I think.

- Yeah, I think you're right.

- Or maybe take a guess. So that's why you really have to compare apples to apples and so on. Apples to apples, you need to do unaided in the sound field. And then you do aided in the sound field. And now even if it's off, you don't care because you're calculating gain. So a mistake and a mistake will even out. Now, for aided sound field testing, that's a whole different ballgame. Now you really need to make sure that your system is calibrated correctly so that when you're at 50 it really is equal to 50 for earphones.

- That makes sense. Okay, next question. You mentioned that many of the special features of today's hearing aids interfere with aided sound field testing. Is it possible to turn those special features off?

- Yeah, so we're, you know, if you go back, and I'm not gonna go through, we listed eight pitfalls that create problems when you're doing testing. And Brian and I were talking about it, it's pretty unusual when you're writing an article, a how to do it article, and you tell the person all the reasons you shouldn't do it. But it's good to know. There's a lot of problems with doing sound field testing. But anyway, hearing aid features, compression itself can mess things up. You could go in and set the hearing aid to linear, I guess go, into the compression. And that might help for higher signals that are above the knee point. One of the things that I don't think you can turn off in most any product, not in Signia for sure. You can't turn off expansion. And expansion, if you remember what expansion is, it squashes sounds that are below the knee point. And the knee point I'm guessing is maybe set around 45, 50, something like that, yeah. So that means any signal below that is, the expansion circuit is going to squash it, and they wouldn't be audible, or at least not as audible as it should be. So that one you aren't going to be able to change at all. Yeah, those are the two that, compression and expansion

would be two that would immediately come to mind. Noise reduction probably won't matter because you're doing tones, but yeah.

- Okay, let's move to the next question. I've typically used warble tones for sound field measures. Is the use of warble tones okay?

- Yeah, I mean, I think if you like it and find it interesting and a little different, probably won't do any harm. My thought is the patient is used to hearing pulsed pure tones 'cause that's what you use during the pure tone test under earphones. So to me, I would just keep using pulse tones just because that's what the patient's already used to. I don't, I guess there'd be no harm in warble tones, again, assuming they're calibrated.

- Right, wasn't the use of warble tones so that people were concerned about standing waves?

- Yeah, I think originally that that was the concern. But I mean, if you're using 200 on, 200 off milliseconds, I'm talking about for your pulse tone, I don't think you're gonna get a standing tone.

- Right, I don't think so, you're right, not long enough. Can I be fairly certain that the threshold I obtain in the sound field is the patient's true threshold?

- I guess we've sort of just answered that. Because if your system is calibrated, yes, it should be close. Although one of the big, big problems of testing in the sound field is test-retest reliability. Patients want to hear that sound, most of them do. And they love to move their head, which very easy can make a five dB difference. David Hawkins did a study many years ago when we were both working at Walter Reed. And he looked, that's when functional gain was just phasing out. And it was test-retest for functional gain. And he found out, he looked at when is a difference really a difference. And he looked at sound field results for functional gain. And what he found is for a difference to be different, it had to be different by 20 dB, assuming you're doing five dB steps.

- 20 dB.

- 20 dB.

- It's probably worse.

- So that means if you had a hearing aid and you got 30 dB for hearing aid A, and you're testing hearing aid B, it would have to be better than 10 or worse than 50 before your second threshold was. So why do the test, which was sort of our point.

- Exactly. All right, one more question on aided sound field. Is there some workaround when a government agency says that you have to do aided thresholds?

- Yeah, okay, you know, Brian said that we listed I think five different reasons why you might have to do aided testing in the sound field. What you know, certainly with implants, unless something has come about that I don't know about, I think, I don't know how you'd use probe mic. One time, there was an idea of how to use probe mic with the bone implant, but anyway.

Let's assume, there's several reasons. Gooney, gooney wax in the ear canal that plugs up the probe tip. Every time you put the probe tip in, the patient lives 100 miles away, they always do. Patients who are down the street, they never have gooney, gooney wax, never. Anyway, you gotta do something, you know, to see if your fitting is even close in the real ear. Maybe then you'd resort to probe mic, but I'd rather do coupler measures and do a correction factor, but anyway. But the one reason is that I am guessing many people experience in that is there's some federal agency that says we have to have aided thresholds, we have to have aided thresholds. So what you can do that will get you close and it's more reliable than functional gain or aided sound field, is to use your probe mic equipment and do what's called insertion gain. This is what we used to do many years ago before we started doing just RE-ARs as verification. And so you would do the REUR, or you'd use an average REUR, then you'd run the RE-AR, the machine then automatically subtracts the two and you have insertion gain. So if you have a hearing aid fitting, you then can take the person's earphone audiogram and you then can, and let's say there was 25 dB insertion gain, and their hearing loss was 50, you then plot up 25, and you can assume that that's close to what their aided threshold would be. It shouldn't make sense because functional gain is unaided versus aided, insertion gain is unaided versus aided. So it should be close. It'll probably more accurate than actually sitting a person down and doing testing. Because of all the problems of doing testing. I don't know that, I mean, you could just pretend like that really was aided. I usually call it predicted aided. And nobody has called me out on that. 'Cause it truly isn't, you're predicting what it should be. But you know, in fact there's at least one probe mic company that automatically will do that for you. If you go into the insertion gain mode and tell you what you want done, it'll then automatically plot the predicted aided.

- Yeah, that's a handy feature.

- Yeah, it is, it is.

- That's all the questions we have for 6.6. Aided sound field. If you're ready, Gus, we can move right into a volume 6.7.

- And I know the topic, it's one of my favorite.

- The occlusion effect.

- I grew up talking in barrels. I grew up talking, a lot of rain barrels, big rain barrels.

- Yeah, I think there's about a 1,000 word essay about barrels in this version that you did.

- I couldn't get away from the barrels.

- So if you want to know about Gus is where he grew up and life in the Dakotas in the 1820s, you can read the first couple paragraphs.

- Got off the Lewis and Clark boat and ran.

- All right, so in this volume we talked about what the occlusion effect is, why it happens, how to treat it, and probably most importantly how to measure it. Here's the first question. In that

volume, you mentioned the pathway of the occlusion effect. How do you know that the bone conducted component from the mandible doesn't simply go straight to the cochlea?

- That's a reasonable question, but I want to just cover myself one little bit on that. In the old days, and you define old days by yourself, it was very common for patients to come in when they had the occlusion effect and say it sounds like I'm talking in a barrel, that's where this barrel thing comes from. So just so you know, there's some basis to this barrel thing. Well, the problem is today that nobody talks in barrels. Every time I have a class in Colorado and a class at Rush, and I always ask the students, how many of you have talked into a barrel? And there was one woman who worked at a sauerkraut factory in Maine who said I've talked in sauerkraut barrels. Usually nobody has talked in a barrel anymore. It's a lost art, really. So the occlusion effect, how does this occlusion effect work? It's pretty interesting because it starts in your throat. When you go it's actually about 120 dB. It goes up to your mandible and sets your mandible in vibration, which goes up to the condyle of the mandible, which is located right by the external ear canal. And it sets the cartilaginous portion of the external ear canal into vibration. So it goes from a bone conducted sound to an air conducted sound. This then sets the eardrum in vibration to some degree. Although if the ear is open, the sound goes, I can do two things. I can just get the heck outta here. I can go wiggle the eardrum. It's a lot easier just to leave, and it does. Okay, which is why you don't have the occlusion effect when the ear's open. So this question then is how do you know that that's really how it works? And maybe when it comes up here on the condyle, maybe it goes straight to the cochlea. This whole ear canal thing is hooey. So my thoughts on this was, well, how would you prove that? And I realized, I was in the study that proved it, and that is we had deep fitted ear molds, and these are ear molds that terminated three millimeters from the TM, when you are wearing a deep fitted ear mold, and I don't know that I would recommend it for anybody. The patients certainly didn't like it. But the interesting thing is there's no occlusion effect. It's gone, and it's in fact really weird because your whole ear is plugged up, but yet your voice sounds normal. So that tells you that it's not going straight to the cochlea, because if it did, you'd still have the occlusion effect. So it tells you that it really is the vibrations of the walls of the ear canal.

- Good. I have heard that you can reduce the occlusion effect by increasing gain in the low frequencies, is that true?

- No, it's not. You can reduce the complaint of the occlusion effect because amplified gain actually masks out the occlusion effect. And speech will sound actually more normal. The occlusion effect is still there, it just got masked out. Now the downside, you know, and this is, fitting hearing aids, you all know this, a lot of times when you start making compromises, you fix one thing, you take away one problem, and you give the patient another one. And of course now you just cranked in all that low frequency gain, which means speech understanding and background noise is probably gonna get worse.

- Good point. Here's a good question. It seems like men have more occlusion effect problems than women, is this true?

- I think most audiologists would say that from their experience. And again, it gets back to having the occlusion effect or complaining of the occlusion effect. I think when we fit hearing aids, it's more common for men to have a noise induced loss, which means that you're fitting them because of the loss at two K and above, and they have normal hearing in the lows. And

those are the very people who are gonna complain more of the occlusion effect. We did a study back in the mid-1990s where we tested I think it was 15 men and 15 women, and we plugged up their ear and measured the occlusion effect, which you can do very easily with your probe mic equipment, I might say, and not only could, I would recommend it, and that's part of the paper, but what we found is there's no difference between men and women. They all, we had them vocalize different vowels measured the occlusion effect, and it ranged from four dB to 22 dB. And we saw that both in men and in women, a lot of it just has to do with how you resonate. Whenever I got the really big ones, the question I always asked the person is have you done a lot of singing? And almost always answer is yes. 'Cause they learned how to really make their whole skull vibrate, which increases the occlusion. Willie Nelson, no occlusion effect, I don't think. On the road again, no nothing, no occlusion.

- You want to do that again?

- No.

- All right, well, some of you may have heard the term ampclusion, and we're gonna talk about that next. And here's the question, you didn't mention ampclusion. I've heard that term caught and tossed around quite a bit. Doesn't that fit into this discussion?

- You know, it wasn't in the article at all. I didn't see a need to bring it up. I guess you didn't either. It is tossed about and it's come to mean something that I don't think was the way it was intended to mean. There was some articles written about how to treat ampclusion. But I went back to the source, the person who coined it, I don't know his first name, but his last name is Painter, and I believe it was in 1993. J AAA, you all can look it up. And what he said, what ampclusion was was the combination of the occlusion effect and amplification, which would make sense, right. Well, over the years it's come to mean just my voice sounds funny due to amplification, but if that was true, you wouldn't call it ampclusion. You'd just call it amplification. So anyway, it's the combination of the two. And actually there was, after, there was an article published, and I won't say who published it, but this person had a nice diagram. This was in Hearing Instruments, had a nice diagram of 20 dB of gain from the hearing aid, 20 dB of occlusion effect equals 40 dB banging on the cochlea. There's just one problem with that, that any student in audiology 101 would know. And that is 20 plus 20 in the world of decibels is 23, not 40. So that tells me that ampclusion isn't really a big deal, because the most it's gonna ever do is three dB. Because if it were 20 and 10, 20 plus 10 is only like 20.6 or something like that. You know, the greater the difference between the two, the more the loudest one plays a part, to where you get 10 dB apart, and then the second signal really has no impact at all. So that's the whole adding decibel scale. So it's used, but I think it's used incorrectly.

- And it's, I think that you make a good point there. Speaking of three dB, if adding equal dB only makes a three dB difference, why is it that some patients say they notice a big difference when only wearing one versus two hearing aids?

- Yeah, that almost goes against what I just said. Do I have to answer that one?

- You can skip it if you want to.

- No, no, no.

- We could phone a friend.

- Yeah, no, no I think this is what it is, because for many research projects, at least five or six, I measured the occlusion effect on a lot, a lot of patients. And what I did see, not usually, but in some occasions, you know, the occlusion effect, for most people, the peak is around 200 to 250 and then it rolls off. For some patients, however, the peak is at 500. And for other patients, depending on their ear geography and how tight the mold is fitting and other factors, how deep the mold is, I would see the occlusion effect peaking at around 15 dB at 200 hertz in one ear, and then at 500 hertz, very little at 200, but peaking at 500 hertz. So if you got both hearing aids in, you got the peak at 200 in this ear and the peak at 500 in this ear, and they're both going together and making the occlusion effects sound very loud. If you take away one of those, you're just left with the peak at one of those two frequencies. And then maybe it's not as bothersome. That's my best guess.

- I don't know. You know, I think we have one more question here, and maybe we can elaborate on this a little bit, because I don't think the occlusion effect, some people out there, especially younger audiologists, may not even deal with it very often, because they fit only instant fit ear tips, double domes and things like that.

- Well, that's one way to, that's one way to get rid of the occlusion effect. It's also a way to really screw up the finish.

- Yeah, so I mean there's, talking about downsides and compromises that could be happening, but this last question might allow us to kind of get into this a little more. Some hearing aids have an own voice processing feature. They're talking about OVP 2.0 from Signia. Does this help reduce the occlusion effect? Somebody is gonna chime in on that.

- I bet, I bet it was Painter, telling me his first name.

- Steven.

- Steven, it is Steven. Did you just look it up?

- No, I didn't. I don't have internet connection here.

- How do you know that?

- Our bunker doesn't have internet.

- How did you know it was Steven? I just remembered.

- Well that's great. You're correct. All right.

- Some hearing aids--

- I got it, I got it. Okay, so the answer is no. It has nothing to do with the occlusion effect. Because let me go back to the pathway. The pathway is the throat to the mandible, to the condyle to the ear canal to the ear. Did I mention the hearing aid, no. The occlusion effect is exactly the same with the hearing aid turned on and off. In fact, that's the nice way in clinic, if you do fit a closed ear mold at some time in your life, the nice differential in the clinic, you can just sit there and say read this passage to me, and the person goes, da, da da da. Nursery rhymes are always fun. And then you just simply mute the hearing aid and say read it again, did it change. And if they say no, it's the occlusion effect. If they say yes, it's gain from the hearing aid. And now you know what pathway to go down relative to treatment. But processing the own voice processing is related to the hearing aid. So it's not related to the occlusion effect.

- Right, exactly, so that's a handy feature because, especially if you're fitting more instant fit ear molds, you're not gonna have an occlusion effect problem. But you might have an own voice problem.

- Exactly, exactly.

- Okay, that is the end of our questions for the occlusion effect.

- All right, God, that was a fun topic.

- There was not one question about barrels. I want you to note that, Gus, no barrel questions.

- Well, I told you it's people just aren't, they aren't just talking in barrels. Just before we move on, that's how I decided to become an audiologist, I would lie on the front porch and talk into this barrel. And then it rained one day, and the barrel was half full of water, and the resonant frequency changed. And it was like this is it, this is my calling.

- Somehow I think that story might be true. Anyway. All right, let's move on to our last volume, 6.8. We've gone through seven different topics, so why not an eighth? It's on self-assessment outcome measures. And in that volume we talked about the reasons for using them, self-assessment outcome measures. We selected three of many, the AFAB, the COSI, and the IOIHA. And then we talked about a step-by-step way to use them in the clinic. So that, just to refresh everybody's memory, that's what we talked about. Here's the first question. What about using the HHIE as an outcome measure?

- Yeah, you know, it's sort of like the pre-fitting test. We sat down and decided, okay, what should we include? What's clinician friendly? What's commonly used? So we're not throwing three new measures. And again, like pre-fitting, there's probably 15 of 'em that you could use. And so we picked the three that we thought each one measured something different. And the HHIE we could have included, because indeed measures handicap, but we didn't. And there's nothing wrong with using it as the answer. It would work fine.

- Yeah, so you could do that.

- It's just a different domain. You're looking at handicap where some of the other ones are looking at benefit, but you probably, the change in handicap is probably very similar to the change in benefit, I would guess, probably somebody's done that research.

- Here's a question on the COSI. What if you're using the COSI and the patient said they didn't experience the items that are on that list?

- That goes back to the discussion we had earlier. You got the wrong items on the list. So I blamed that on whoever was with that person when they picked their items. Catherine Palmer and Elaine Morner did an interesting study related to this. And they found out that they had these people who I think picked four items on the list. And after a month they came back and they had 'em pick four items again. And almost 90% or so picked two of the same. But then it fell off drastically. Because, you know, people tend to pick things that are fresh on their mind. And so it would be very possible that there was one or two things they never experienced. But if they didn't experience all of them, some of them, I mean, you know, like I usually try to get something on there as simple like having dinner with your wife. Well if you didn't sit at the dinner table for a month, you know, maybe you got a divorce, I don't know. But so you want things, that goes back to what we said before is that you want to back off and say, look, let's get some stuff that you experience all the time.

- Things that happen everyday.

- Yeah, and then that won't happen.

- Take me through a typical day and they'll get the answers that they need. All right, should the aversiveness rating on the AFAB agree with the patient's LDLs?

- Ah, aversiveness, for those of you who have never done the AFAB, the AFAB has four subscales, listening and quiet, which Robin Cox called ease of communication, background noise, reverberation, and the last one is aversiveness. That was the screeching of tires. But it's sort of how bothered are you by loud sounds? I think if a person was really sound sensitive, yeah, then.

- Well, some of 'em aren't loud sounds, are they, they're more annoying sounds.

- Annoying, annoying, flushing of a toilet, I think is one. So yeah, I think it's possible. But if somebody did a study and said they didn't agree, that wouldn't surprise me.

- That's good to know. I want to remind everybody that you've mentioned a lot of studies, and if you go back to the written versions of each one of these quick takes, you will see the references that Gus talks about here listed at the end of each one of the quick takes.

- So I just wanted--

- At the end of each volume we probably have 50 references or so.

- Yeah, there's a lot.

- Including Steven Painter.

- Exactly, that's there.

- Steve, my good buddy Steve. I call him Steve, you call him Steven, but I call him Steve.
- Yeah you're on a more informal basis with him.
- I knocked off one syllable there. I know him a little better than you.
- I guess so. Let's go the next, we have another aversiveness question about on the AFAB, It seems that with the AFAB, the aversiveness findings are usually worse for the aided condition compared to the unaided.
- Yeah, you know, that bothers some people. They go, my God, I made things worse. But that's the expected finding, simply because people are more bothered, like the flush of a toilet, it's a good example, because it's audible, you know, and it became more annoying. In fact that's a common thing that people come back and sort of complain about or remark about, I guess would be the word. What we published in that particular article we're on 6.8, 6.8, quick pick 6.8. If you look in that article, at the end, we published the norms of the AFAB, which I'd definitely encourage you to use for patient counseling. And I think what you'll see on the norms is the 50th percentile for unaided for aversiveness is around, I'm gonna say around 15, 18%, something like that. For unaided, aided it's up around 35, 40%. And that's the norms, that's just the way it's gonna be. You know, so don't let that bother you.
- Well, when you think about it, when you hear it for the first time in a long time, you're gonna of course report higher scores.
- And a lot of, I can't remember how long people had used hearing aids when they collected that normative data. That would also be a factor. You know, the longer they use hearing aids, the less bothersome it's gonna be.
- Right, okay, on the COSI, is it necessary to have the patient complete both the degree of change and final ability scales?
- Well, as I was sort of jokingly saying that the COSI starts off at a blank sheet. It's sort of blank, but it does have scoring on it for how you would score. And for those of you who have never looked at this form, by the way, we published it in the article. And so you can just pull a copy and paste out of there. Or you can go to the NAL website and download it. They encourage the use, and it's not copyrighted. But it is more or less a blank form, but it's scored in two different ways. The one is degree of change and what's the other one?
- Final ability.
- Final ability, yeah. And basically what, and I haven't done this on more than 50 people or so, but usually you get sort of the same results both places. In both cases is looking at benefit.
- Yeah, they're just slightly different versions of benefit.
- Exactly. So I mean, if you really just only wanted to do one of the two, I think you, it would serve the purpose.

- Well in my experience, the degree of change is an eyeopener for a lot of patients. 'Cause you can say you move from a one, which you didn't hear anything at all, to hearing almost everything, to a four. That's a pretty big degree of change.

- It is, it is.

- Versus somebody that maybe only one from a one to a two.

- What is four, almost always. Five is always I think.

- I think almost always. But on a five point scale.

- Which is good, I mean, you know, because some of these are difficult listening situations.

- Sure, yeah, yeah, all right, next question. When is the best time after the fitting to conduct these outcome measures?

- Well, there's the practical reasons. And then there's when you might get the best results. I seem to recall Larry Humes doing some work. This probably, what, long time ago. 15, 20 years ago, where he measured on outcome scales change over time. And I want to say that he found that the best performance was after about two months was the best performance, because on two months and one day there was a plugged receiver. Well, that would be true today, maybe not when he did that study. But anyway, two months was good. Now from a practical standpoint, I know the rules are different in different places and different states, but the 30 day rule still applies, doesn't it?

- In most places, yes.

- Yeah, so you want to get that person in before the 30th day. You want to bring them in, I'd say after two, three weeks and do your follow up, because if something's not going right, you want to know it. You don't want to wait till they walk in with the bag and the literature on the 29th day. You want to catch 'em before that. So, you know, I'd say after two, three weeks would be a good time to do it.

- Well it looks like we are are finished. I don't see any more questions here on the list. Wait, somebody, I've been handed, you know, we have operators here working around the clock.

- I saw them, they're in the bunker.

- So we have one, if you have time.

- I got time, I got time. I've got more time than money.

- One final question here from our operators, thank you. And here's the question. I mean, it's not anything earth shattering, but it's a good question. I'm not sure why we have operators taking these questions.

- But it's good.
- Here's the question. Is the IOIHA commonly used?
- Good question. You know, I don't know. It's a great, but for those of you who don't, that's the international outcome inventory for hearing aids. You call it the IOIHA, I like to say IOIHA, IOIHA.
- It sounds like somebody who can't pronounce Iowa.
- So anyway, the IOIHA, you know what's great about it, you wrote a paper I think about it a few years ago.
- So long ago that I can't remember anything about that.
- Well, I'll tell you what you said maybe. Well the one good, it has seven domains. And one question per domain. So, you know, if you take, I know this isn't answering the question.
- That's okay, it's a good refresher.
- But maybe somebody hasn't read the article. So the, if you take the AFAB, the AFAB is measuring one domain benefit, you know, that's what it's measuring. Or disability, depending on how you want to word it. The IOIHA covers seven different domains, seven different domains, but just one question, it goes from hearing aid use and hearing aid satisfaction, hearing aids benefit. Did it change? Did people around you notice a difference? Overall satisfaction--
- Quality of life.
- And quality of life was, yeah, so that, I think we named all seven. It's a nice test and the beauty of it is it's used all over the world. It's translated into, I don't know, 15 different languages. And if you only had to do, you know, you wanted to get a lot of pieces of information, it would be a really nice, handy way to do it. If I owned different offices, I would compare IOIHAs from this office versus this office. If I had four audiologists working for me, I would compare individual ones and to see, you know, is why is satisfaction better with Bob than it is with Mary? You know, I think it has a lot of use. but I don't know if people are using it or not. I don't hear a lot of people talking about it.
- I see it more and more in research studies.
- Yeah, it's commonly used in research.
- Yeah, but it's an easy, in the clinic, I think like to all of your points, it's the--
- Well, you know, and I'm not in private practice. And haven't been for, since '95. So it was, things change, but to me, it would be a no-brainer to, I mean, if you buy something on Amazon, they're rating your satisfaction. I mean, you know, if you go buy a bag of oranges, you're gonna get a question on do you like your oranges? So it just seems logical to have people to fill out

the scale and you just keep documentation on it. And one more thing, Sergei Kochcan proved this, that by asking somebody if they're satisfied, you improve their satisfaction by 7%. So it's really a no-lose kind of thing.

- Right, just the act of administering the tool.

- Yeah, good question.

- So our operators have not brought us any more questions, so I think we're finished. Gus, I can't thank you enough for all your time.

- It's great, and how we ended up in this location, I don't know, nor am I telling anybody.

- If you don't hear from us, we're probably still here.

- The door is locked, I know that.

- Thanks for joining us. And see you next time.

- Thank you. Thank you for the invite.

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