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Signia Expert Series: Is autoREMfit a Reasonable
Verification Alternative?
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Partner: Signia

- - [Narrator] Good afternoon everyone. I'd like to welcome you to another installment of the Signia Expert Series. Today I'm delighted to introduce Doctor Gus Mueller. He's going to be presenting his course, Is autoREMfit a Reasonable Verification Alternative? Doctor Mueller holds faculty positions with Vanderbilt University, The University of Northern Colorado, and Rush University. He's also a consultant for WS audiology and the contributing editor for Audiology Online, where he has the monthly column 20Q with Gus. Doctor Mueller is a founder of the American Academy of Audiology and a fellow of the American Speech Hearing Association. He has published extensively in the areas of diagnostic audiology and hearing aid applications. And has co-authored 10 books on hearing aids and hearing aid fitting. Including the recent three-volume Modern Hearing Aid series. And the clinical text on speech mapping and probe microphone measures. Gus is the co-founder of the popular website, www.eartunes.com. And resides on a North Dakota island just outside of Bismarck. So with no further ado, I'm going to turn the presentation over to Doctor Mueller.

- Okay, thank you Lisa. And yes indeed folks, welcome from North Dakota's largest island. I'll give you a photo here just in a minute. I'm not sure but I guess maybe I'm supposed to read these outcomes to you, or they're just supposed to be on the screen. I think they're on the screen long enough, so let's keep moving along. In the spirit of full disclosure, Lisa already mentioned this, but let me repeat it. Indeed I am a consultant for WS Audiology, which for you people who are not heavy into the hearing aid field, the W stands for Widex and the S stands for Sivantos or Signia or Siemens whatever you want it to stand for. And I also am a contributing editor to Audiology Online. So actually I'm sort of blending my two consulting activities together here today, which is very convenient. You know, they like to keep these webinars timeless so what I thought I would do is provide you a photo here which could be any month of the year in North Dakota. This is indeed taken from the largest island just west of Bismarck, just a little distance from my backyard looking across the Missouri River. A

gorgeous place to live. For those of you who might be interested in probe-mic measures in general, I thought I would put these two courses up, they will be in your handout. These are also webinars here at Audiology Online. The first one is really for those of you who are just getting started doing probe-mic measures. It's an overview of things like, where do I put the probe tube? How do I position the patient? That sort of thing. And then the second course below that is sort of for the opposite end of continuum. These are the ones, this is for you people who do it everyday, all day and you get a lot of bizarre findings and you go, what the heck is going on? In this particular webinar, I tried to find eight or 10 sort of bizarre things and come up with what I thought might be the solution. Just to get us started, although it relates directly to the first portion of this talk is I've always liked the ads that have come out of Verifit.

This one is geez, probably from 10 years ago or so. And as you can see, it's making the point that maybe average isn't for everybody. Here's another one of my favorites, that manufacturers first fits are a shot in the dark. That's actually putting it kindly. And then, I don't know how long this last one's been out but I personally just saw it a couple months ago. I think this one was pretty good. And that is if patient feedback was this helpful, you wouldn't need Verifit or any probe-mic system for that matter. So this actually leads into the first portion of my presentation. And that is before we get to autofit, we really need to establish some ground rules. And you're gonna see a little bit later why this is critical when and if you choose to use autofit. So we have to remember that what we're doing is verification. A probe is not a way to fit hearing aids. Probe is a way to verify your way to fit hearing aids. Which guess what? That means you have to have a way. So let's think this through. So you're sitting down and your eight o'clock patient is coming in to be fitted with hearing aids. You're gonna charge them a ton of money for these things because their getting premier fittings. And you want to make sure you send them out the door with the optimum fitting. So you really have three choices, the way I see. You can come up with some fitting algorithm that you made up. And this might sound corny but people walk up to me and say, you know Gus, I don't

use that NAL stuff, I have a better way to fit hearing aids. Oh really, but some people think they know better. So you could use something you made up. You could use something that a hearing aid manufacturer made up, and that is available from most all manufacturers. They sort of came up with their own little way to fit hearing aids. Or you could use something that's been validated with 30-40 years of research. Given that most of you listening today have eight years of college, this shouldn't be a real tough one. I think we're gonna go with this. Well, what comes next? How can you then ensure that your fitting goals are being met? So now you know your prescription, you know your blueprint, you know where you want to go and so what are your next choices? Well you could click on the manufacturer's magic button, the button that says or tab that says, NL2 or DSL and you could click on that. You could look at the fitting screen and see a perfect matched target and go, wow, I am a good person, look at that. That would be one choice.

A second choice, you could actually ask the patient. Hey Bob, are you getting around 92dB SPL at four K? Or here's a radical thought, you could actually measure it. And again, this isn't really difficult decisions. This is your basic logic, 101. Curious people might ask, is there a Plan B? How else could you possibly fit hearing aids in an ethical and moral way? Now the skeptic then might ask, is there any proof that Plan A works? The plan that I just outlined here. Well I guess we first have to ask ourself, for those people out there. Obviously none of you listening today or you wouldn't have tuned in. But there's a lot of other people out there who do have a Plan B. And what is their Plan B? By far the majority is to use the manufacturers proprietary default fitting with no verification. How do I know that? Because manufacturer's have spy software on your computers and they know what dispensers click on. And by about 80 percent what is clicked on is not DSL or NAL, it's the proprietary fitting. Well I would say over the past 10, 15 years, there's been a dozen or so studies that have really shown that proprietary fittings don't work very well. And I'm not gonna go through all of them. I have in other webinars but I thought I would just go through one or two. This one was just from last

year, a very well-designed study and of course the lead author or lead investigator was Mike Valente. Somebody well known for doing excellent research with hearing aids. So this was a very well-controlled study. I'm not gonna go through all the details, this was published in JAAA, you can read it yourself. But I do want to show you some of the results. Here's the summary and then I'm gonna go back into the details. He found that in the clinic and the laboratory improved performance for speech recognition for the NL2. In the real world there was improved results for the AFAB. And after the real-world trial 19 of 24 people preferred the NL2 algorithm. So here's some of the details. Now I know this might be a little hard to see but what Mike has done here has done an average of the proprietary fitting.

And by the way, this was just one manufacturer but I can tell you that the mistakes from NAL, if you think of them as a mistake are basically the same for all manufacturers, we've done those studies. What I'm gonna do to make this a little easier to see is I'm putting a red line up here, that's the NAL fitting. So if all the X's were on the red line, then it would be a perfect fit to the NAL. Well as you can see it isn't. What I simply did is did some averages. I did an average of two, three and four. And what you're seeing is the average mistake for soft speech is 14 dB. The average mistake for average speech was eight dB. For loud speech, it was relatively close. What of course we're concerned with is those big, big differences for soft speech. Now I say mistake but actually for the 80 percent of people who use proprietary fittings, it isn't a mistake because somehow in their mind, they believe that their patient should have 14 dB less gain than what they need. Obviously these patients aren't going to be happy with hearing aids, which leads us to part of the problems that we have today in the US with many hearing aids not being used. It should be to no one's surprise that they're not being used. And we'll talk more about that later. Well here's some data. This is for speech five dB above the average. So you see when you present a patient with fairly loud speech, well then that lack of gain isn't as critical because you're overcoming it by making the speech louder. But just the same, this was a significant

difference. And that is the NAL was significantly better than the proprietary fittings. What you're seeing there are box plots and so it's the 25th to the 75th percentile are within the box. So you see even here for the NAL, the 25th percentile is almost as good as the 75th percentile for the proprietary. The vertical bars are the range of scores for this. But let's see what happens when we go to soft speech. Now you see what you would expect and that is there's a huge difference between performance with the NL2 and performance with proprietary fittings. If you simply look at means, you're looking at what about a 25 percent difference but notice now clearly, the 25th percent with the NAL is better than the 75th percent. And we have people performing as poorly as 20 percent with proprietary, where the worst performer was 65 percent with the NAL.

So you don't have to be a wiz at statistics to know that this is significant. What bothers me is that I will bet a six-pack of your favorite beverage that somewhere, someplace today that there's a rep telling a naive Audiologist, trust me, trust me, our hearing aids work the best when you use our proprietary fitting. Work the best? Look at this, look at this. This is a slide I made up using Mike's data. This is his results from the APHAB. And what I did is, I added Robin Coxes APHAB scores for people with normal hearing. Excuse me, elderly people but with normal hearing. So what you see in these three bars is you first see the default fit then you see the NL2 and then you see the people with normal hearing. And what you can tell first of all, well I hope you can tell, there's a significant benefit for the NL2 and what is also interesting is when fitted with the NL2 in the real world, these people are performing as someone with normal hearing. So, my first tip of the day, manufacturers' proprietary fitting, gone. That's an easy one. Okay, let's talk about the other Plan B and that is that you simply hit the NAL button but you do not do verification. What's the probability if being in NAL targets, here's a study from 12 years ago. They found that the probability of actually fitting to NAL was only 36 percent of the time you'd be within 10 dB. This same group repeated this study back in 2012, it actually got worse, only 29 percent within 10 dB. Here's a study that we did at University of Northern Colorado a few years back. The zero line would be a fit to NAL,

what you're seeing here is five manufacturer's. So what we did is we simply pushed the NL2 button in the fitting software and then looked to see what was really happening in the real ear. And what you see here is that in the real ear, in the high frequencies were making mistakes of around 10 to 14 dB, even though in all cases, the fit-to-target was perfect on the fitting screen, and this is 80 fittings. So this hasn't changed. So my second tip of the day, use of the manufacturers' NAL and fitting screen simulations, gone. Well how big of a problem is this really? Well I don't know what it's like across the entire US. I do have a pretty good idea what it's like in Oregon.

The reason I know that is a study senior edited by Ron Leavitt who has a practice in Oregon. Now some of you are maybe looking at the authors of this and you're going, wait a minute, wait a minute, Ruth Bentler, isn't she in Iowa? Well she is but they actually have some really great Pinot Noir in Oregon and I'm thinking that got Ruth out there for at least a few days. So now let's talk about these results. They looked at, well first I should say, they had 97 patients, 176 fittings. This came from clinics all over the state because Ron conducts a rehabilitative program where people come in and spend time with him. So what we have here is the mismatch from target by five dB or more 98 percent. Mismatch from target by 10 dB or more, 72 percent, exactly what had been shown in other studies. And in case you're interested, the mismatch from target was no different when the hearing aid had been fitted by an audiologist or a hearing instrument specialist. Hopefully that doesn't surprise anybody. Because if your 10 year old clicked the NL2 button it doesn't matter who clicks the button, the bottom line is, fitting isn't good. So we have a big problem and we need to fix it. And it goes back to this, you start with a good theoretical base and then you come up with how are you going to verify it. So then that leads to autoREMfit. Can autoREMfit help? So let's talk a little bit about autoREMfit. So I'm guessing some of you listening have never used it, maybe never even observed it. So it's a method of integrated/automated verification. The way it works is either the fitting software of your favorite hearing aid company borrows information from the probe-mic equipment, or it could be the other way around, the

probe-mic equipment borrows information from the fitting software. Most systems will fit to both the NAL and the DSL, in fact I think they all do. And get this, you can maybe even autoREMfit to the proprietary, isn't that great? Hey man, I know a fitting that really is bad and I can do it automatically, woo! Which is why I had to do the first portion of this talk, so you get that. So the audiologist of course has to make background decisions like you would in any fitting. You need to make sure that all the background is set, is it a bilateral fitting? And the age, is it an adult and where the pure-tone thresholds come from and all of these types of things, like you would with any fitting. And then like with any probe-mic measure, you have to assure that the patient is position correctly, that the probe tube is placed correctly. And then the software sort of leads you through it.

This is now, not the software of the probe-mic equipment but the software from the hearing aid manufacturer. But the cool thing here then is the actual programming of the hearing aids, is conducted automatically. So you can just sit back and watch it happen on the screen. Some common names for this, now this autoREMfit is a name that Todd Ricketts and I came up with a year ago when we wrote an article. Because we wanted to use a term that was descriptive and also a term that wasn't already being used by a given manufacturer, so it didn't look like we were just linked in with a particular manufacturer software. So some of the common names are, Oticon calls it REM Auto-Fit. Phonak calls it TargetMatch. ReSound calls it AutoREM. Signia calls it AutoFit. I believe these are correct. Sometimes when new software comes out, manufacturers' change the name of things but at least a few months ago, this is what it was being called. Now the probe-mic manufacturers might have different names for it and in fact they do. And the downstream brands of the above companies might have different names for it. So here we just have, I just took the top six brands but as you know, all of these brands have families. So you know, Oticon has Bernafon and Sonic. And Phonak has Unitron. And ReSound has Beltone and on and on. So I'm not gonna go into all those secondary brands. Some of them I suspect also have autoREMfit and

in their software it might be called something different. From the probe standpoint however, you might ask yourself if autoREMfit is something new. Here's a slide that you see, this is out of a journal article and on you see is the top, this was before Autofit and down below you see after Autofit. This is from an article in Trends in Hearing. Probe-mic measurements: 20 years of Progress? Written by a guy name Mueller in 2001. So autoREMfit has been around since 2001. To put that in perspective, a cell phone with a camera was not invented until 2002. I don't know if that's ever gonna fly or not but back in 2002 somebody thought it was a good idea and they tried it.

Who is integrate with whom? Well let's see. It goes sort of like this. Oticon is, and I believe this is all correct, to the best of what I could tell by making phone calls and emails in the last couple weeks. Oticon would be integrated with those four probe-mic companies. Phonak is with Otometrics. ReSound would be with MedRx and Otometrics. And Signia is, as of next month, will also be with Verifit and they also are right now are with MedRx, Otometrics and Unity. From a probe-mic equipment standpoint, the company, I got this from Peter Cosak from Otometrics. There's all the software the Otometrics is integrated with. So from a probe-mic company, they probably have the most of anybody. So why you might like using autoREMfit. The fit-to-target most likely will be faster and there are some data on that. It requires less thought. Maybe your tech could do the fittings for you. You got everything all set up perfectly, it's like, okay Joe, you do the rest, I'm gonna go grab a cup of coffee. If you're not experienced in doing fittings, I mean if you don't really understand when you need to change gain and when you need to change compression, when you need to change the NPO and when you need to change the Y-dynamic range compression. If you don't get all that because if you don't get that, you're not gonna know what tab to go to. It could be that the autoREMfit will actually give you a better fit-to-target then you're gonna do on your own. And I know many of you have one or two favorite companies and all of sudden somebody walks in the door with the brand that you don't usually fit, you don't want to really lose the patient because they might need new

hearing aids in a year or two. And so you stumble through trying to fit them with this hearing aid that you really don't want to be working with. It could be at autoREMfit might save you in this case. Because then you don't really have to learn the software you can just do an autoREMfit. And you know, maybe you could use it as some kind of sales tool. You could spin a story that you're the only person in town who has this computerized super intelligent way to fit hearing aids, possibly. Well, why you might not like using autoREMfit. And there are some reasons. Well there hasn't been a lot of research with it. Maybe the fit isn't valid. That would be a pretty good reason right there for not using it. The fit might be different from your preferred method of probe-mic verification, as we're gonna talk about shortly. Some of these methods use the REUG. I'm guessing that 2/3 of you out there never measure the REUG when you fit hearing aids.

Are you going to be okay using the REUG or would you prefer not to? The fit might not be for the input level that you prefer. I personally think that fitting to soft speech is one of the most important things you're gonna do. Some of the systems might only fit to average and let soft fall where it will. You might not like that. And for some of you, you just might not like the whole concept. You may be or known in your area as the person who really knows how to fit hearing aids. You might be the only one doing probe-mic measures. People might be coming to you because of this skill that you have, well I don't know, well I guess it is a skill. Well at least the seriousness that you take fitting hearing aids. But now everybody can do it. You know, including the clerk at Walmart. So you know, maybe you don't like that concept that it's too easy. So and I could maybe see somebody thinking that way. So let's talk about some equipment examples. My thanks to John and Navid for just giving me some slides from their equipment. So we're gonna be looking at a Signia Unity and then as you saw Verifit is linked with Otocon so then the second example would be the Verifit Otocon link. So we're starting here with Unity. So it's Signia hearing aids, the Unity probe-mic system. And so the way this system works is you start off with a bilateral measure of the real

ear on aided gain. So we're in the gain mode here now folks. So this is going to be REIG for those of you who are used to looking REARs. So what we're now looking at is bilaterally we're measuring REUGs. What you then do is you would select AutoFit. And once you select AutoFit, you then see these targets displayed. And this is for 55, 65 and 80. Remember we're in gain, so it's upside down than if you're looking at REAR. So the bottom line is for loud and the top line is for soft. So we now have these targets and what you see here, actually I should have shown you the little movie but I was afraid it wasn't gonna turn out so I skipped the movie but we could actually watch the screen while this is happening. But just take my word for, it happened. And what you now see are the black lines and so the black lines is AutoFit. I'm actually a little surprised on that right ear, which is the left of your screen. Usually it's a little better than that but that's still pretty close. So that's our AutoFit for 65 dB. And what you then can do, this equipment encourages you to do a loud verification. And so what you see then are the dotted lines down on the bottom of each chart. Where I pretty much nailed it for loud. And at that point, you would consider it fitting. Now one of the things that you will notice and this is a good thing by the way. Is after you finish AutoFit, if you now go back and look at the fitting screen.

So now we're not looking at the probe-mic screen anymore, we're looking at the hearing aid fitting screen. What you see here is what it looked like before AutoFit. So the simulation, it says, man you got a perfect match-to-target. And of course, it always shows you that, which is why we know it's wrong because once you actually do the fitting, you see that it doesn't match on the fitting screen anymore. Nor should it. If it did, then you wouldn't have had to do AutoFit in the first place. Okay, let's move on to the Oticon and the Verifit. So this is Verifit obviously calls this the Verifit Link. And what you see here is that you would select REM in the Oticon fitting software. And what you see over on the right then is the Verifit then wants to know some things. And these are the things that Verifit always wants to know, it wants to know what your measurement method was, it wants to know what fitting rationale, it wants to use what signal type, in

this case, we're using the ISTS, and then it wants to know where you're getting your RECD. Did you measure the RECD? Or do you want to use average? Or apparently you can pull it from the Oticon software, which is what I assume Genie 2 is. Then you move on to the measurement process. So what you see here now is, and for this system we're in ear canal SPL. So now up is loud and down is soft. And so you can select the levels over there on the right that you want to use. You can decide down on the bottom if you want to do, left, right or both. If you want to do, by the way for those of you who don't do probe-mic a lot, over the last five years or so, it's been very common for people to do bilateral measurements, simultaneous bilateral measurements, which saves a little bit of time I would guess. And what else, oh there's one other thing here I wanted to point out. And we're gonna talk about this later. Notice that written on this slide is that the SPL threshold, the SPL, UCL and targets are generated by Verifit. So the targets are generated by Verifit. The targets are not generated by the Oticon software. While this testing is going on, you can view it both on the Verifit screen and on the fitting screen at the same time. And following it, following the fit to 65, if you then want to fit to another input level, you can do that. You see there, what you're seeing on the screen now is the autoREMfit to 65.

Okay, so that's just a quick little review of a couple of the systems and as you saw, there's I think, what was there 12, 14 different combinations you could have between a given probe-mic equipment and fitting software. Actually more than 12 if you count all the downstream brands. So here's, this is, it's sort of a stretch to call this research but this was something that Todd Ricketts and I did a year ago. And that is at that time, there were four companies that had autoREMfit. All four of those were on the Otometrics. And we thought it would be good to just sit down and do a head-to-head comparison and sort of from a bystander standpoint. So I'm gonna get into in a little bit, the research with this procedure has pretty much been done by people from either the probe-mic company or from the hearing aid company. So since Todd and I really didn't have a dog in the fight, we thought that we could just sit down and hopefully

objectively look and see how this worked. So our concern was if you use the autoREMfit, do you then end up with the fitting that would be the same as if you'd fit hearing aids the traditional way. Or at least what Todd and I consider the traditional way. So that's the fourth bullet point here, is that what we considered is the traditional way is you do, you do what is commonly called speech mapping. In other words, you're fitting an ear canal SPL using the REAR, you would typically use three levels such as 55, 65 and 75 and you would use a real speech input, the one that we recommend is the ISTS, simply because it's available all probe-mic equipment and it's used around the world. And so that is what we would consider a sort of a standard method of verification. So to understand what we did then, we took each companies autoREMfit and then after we completed it, we went back, well we didn't really go back, we didn't change anything on the hearing aid, we simply just did a standard verification. And here's what we found.

So what you see here is three different companies, 55 on the top, 65 in the middle, 75 on the bottom and what you're seeing is the deviation from target. So if it was at zero, that's a good thing obviously. And if you notice, Mr. Green really did a nice job. Mr. Green really didn't deviate from target much at all. The worst of these three was Mr. Red, who is down five dB or so from target on average. But still not bad for those three. If you were reading earlier, you would have seen that we had four companies. What we didn't show was the results from product four, which had mistakes of 10 dB or more for all inputs. Our understanding from that company is that it was a software glitch and it has been fixed. But it was so bad we didn't even put it on the chart. But here's something for you and I know you're gonna say, what was that company? Well here's my answer. Do it yourself, it's actually fun. So what you can do is if you're considering using autoREMfit and your probe system is compatible with your favorite hearing aid brand, which may not be the case but let's assume it is. You grab a couple friends and colleagues over lunch and you know, it can be anybody, normal hearing, they don't have to have hearing loss. Fit them with your favorite-brand of hearing aid

conduct autoREMfit, enter an easy-to-fit audiogram you know, Todd and I used 20 in the lows, sloping down to 60 in the highs. Conduct your autoREMfit and then without any change, then do exactly what we did. And do that with a couple people and you'll get a really quick idea, if you're getting valid results. Well here's some research that's been published on this topic. So here is one of the first ones on this that was, well not counting the Mueller one from 2001. We then skipped 13 years and we have this one done a few years back. So this one was mostly looking at the time that it takes to do the fitting. There was one comparison between clinician fit and autoREMfit which I don't really see as relevant because they didn't compare it to target. They just compared the two to each other. So I'm not gonna talk about that. But this was from ReSound and the probe equipment they used was Otometrics. And here's what they found.

Now the Y axis isn't labeled but I'm gonna assume that's seconds. And from those of you who don't like dividing by 60 I'm gonna help you out. And if we look at the mean, what you see here is that the autoREMfit took about three minutes, the manual method took about five minutes. Here's another study. This one was just published last year. This one was using the Signia hearing aids and the Unity AutoFit procedure. So they looked at three different things. They looked at REI, remember Signia now is REIGs so they were looking to see how close that came to the actual NAL fitting. Then they did test-retest, where they repeated the autoREMfit measure to see if it was reliable. So we're looking at validity, then we're looking at reliability. And then they did just like what Todd and I did, is they went in and then compared it to REA-based, NL2 prescriptive targets to see what we get. So first of all this was to see if it was close, now remember this is in searching gain. If it was close to targets and yes indeed it was, it looks like the mistake isn't more than one or two dB. Test-retest I would say something that's below, all of them are below 1.5 dB, that's certainly great. And here is the mean compared to standard speech mapping. So you see it's pretty close to zero, like I would say it's fairly acceptable down at around four dB. Now this is the mean,

this is not RMS which could be larger than this, we don't know. So here's another study. This was also from 2018. By the way, at the end of this, you'll have an outline. I give you the exact references for those of you who want to look them up and get all the details. What these authors did, is they compared autoREMfit to the manufacturers first fit. So this is the magic button that I was talking about earlier. Then they compared it to the clinician fit for both DSL and NAL. And they again looked at test-retest for liability. We'll start with the test-retest for liability and they looked at both the REUG and the REAR as you can see all of those numbers are really small. The RemFit was slightly better than clinician fit. But even the clinician fit was quite good for test-retest. And this of course is what we've seen with probe-mic measures there for a long time. As your test-retest tends to be around two dB or so for most frequencies.

So here's what the results are. The first fit mean target mismatch across all frequencies was 4.3 dB. So that's before you did any tweaking at all. Then I find this sort of weird, the clinicians mismatch, this is now after the clinician programmed the hearing aid, it got worse, 5.4 dB. The point they're making of course in the article is if you did autoREMfit, the target mismatch on average was 2.6 dB for the DSL and 1.5 dB for the NAL. Better than clinician fit or first fit. I sort of, I couldn't quite figure out why the clinician fit would be worse than first fit. But they showed this slide and it appears that for some reason, what drove that number up what out in the high frequencies if you notice the clinician fit, is they're making about 10 dB mistakes in the high frequencies, where the autoREMfit did not. And I have no idea why a clinician wouldn't match targets there, but anyway. And I think this is our last one of these. This was now done with the Western Ontario Western University in Ontario folks and John Pumford from Audioscan. And so what we have then is the Verifit and Oticon. And so what they did, they did actually several things. They compared it to manufacturer's first fit, clinician fit, autoREMfit. They also looked at test-retest and they looked at the test time. So we got lots of information on this one. So the first thing they found was the test-retest. This was for seven of their subjects. Again, about one and a half dB, something in that

order, what you saw in previous research. Here is the fit-to-target. This to me looks very believable. It's exactly what I would predict. And that is that the manufacturer's fit, of course is the worst. Then when you do the Verifit length, your mistake looks like it's running at around four dB or so. And then the clinician's fit is just a hair better but not statistically better than autoREMfit. What you see here is the mean frequency response. I just showed it to your for 500. And again, you're really seeing the same thing. The yellow line, which is the closest to target as the clinician fit. Just below that is the autoREMfit. And then you have the manufacturer's fit, this is when you do no tweaking but just program it according to DSL, in this case and you see the mistake that it's made. Here are the mean SII values, which follow the same pattern as you saw from the deviation from target, not surprisingly. Now here's the time. Their times are a little different than what you saw in the other study, but not terribly so.

So you have the manufacturer's first fit, which is only two minutes because basically it's just the time it takes to put the hearing aid on the ear and pushing a button. And then you have the Verifit Link which is up around four and a half minutes or so. And then you see the average clinician fit is around seven minutes on average. And so indeed, the conclusion I would reach from this is that your fit-to-target is as good, remember there wasn't a significant difference and you can do it in about half the time. And I'm not gonna go through this but this will be in your handout for those of you who want to look up those four studies. So issues to consider. Here's what I would be thinking about if I were to launch into doing autoREMfit tomorrow morning. As I mentioned, some autoREMfit procedures use fit to the REIG, not the REAR. And some of them use individuals, REUG. So most of you out there don't fit hearing aids this way. Not in the US. Those of you listening in the UK, you probably fit hearing aids like this, maybe Australia. But in the US we typically fit to the REAR. So this is something to consider. Are you okay with that? Or does it matter? It does by the way, because I'm gonna show you that here. So this is something again, back from when Todd and I, we looked at one of our subjects who had a rather unusually REUG. And unfortunately I

don't think we saved that REUG but you'll be able to figure it out here in a second. I summarized it over on the left. This fellow had a big peak at 2000 hertz in the REUG. Normally it's out around three and then out at 4000, where you would expect contra effects, there was essentially nothing. Now, if you understand how REIG works when you use the patients, when you use the patients own REUG, is what happens is, you build into the REAR or the REAG. You build into that gain to compensate for the REUG that you took away. So the logic if there is logic is that, Bob here had walked around all of his life with a peak at two K, what we're gonna do when we fit the hearing aid, we're gonna give Bob a peak at two K so that it will sound normal to him. And this is an accepted way of fitting hearing aids. It was the most popular way of fitting hearing aids until NAL came out with targets for the REAR. And if you're old enough to remember, there was a time when there weren't REAR targets for the NAL and we fit to insertion gain. That was all we had. But you see what happens here now, so the auto-fit built in those corrections and I'm guessing it was a beautiful fit on autofit, looking at REIG.

However, now we've gone over to speech mapping. And the result was so bizarre, we ran it twice. Which is why you can see there's a red and blue line which is just our test-retest for the same thing. Which are on top of each other, which means it was indeed a valid measure. And you see what happened here, now that we're trying to fit to the REAR and that is we have way too much output in the two K region. We're over fitting by 10 dB and look what's happening out in the four K region, we are under fitting. In fact, we're under fitting to the extent that if you can barely see there that little soft x, faint x I guess would be the word, it was soft too. And that is that we're at the average speech spectrum, the average of average is actually below threshold. Where look where it would be if we were on the dotted line, we would be about 10 dB, above threshold. Which is the whole reason we use the REAR in the first place. You know, Richard Seewald pointed that out to us back in to 1985 of the hazards of using insertion gain. So this can be a problem. Now if a persons REUG is average, then it shouldn't matter. Another issue, some of the autoREMfit procedures turn off all the

hearing aid features during autoREMfit. These would typically be the ones that use noise perhaps as part of their fitting, another thing to consider. We also know from research that the manufacturer's prescriptive targets are not the same as those generated by the probe-mic equipment. So do you really want the system to fit to probe-mic targets that you already know from research are not very good. As you saw, they tend to fall five to 10 dB below on NAL. Well there's the chart right there to remind you. So let's say that your favorite company was Mr. Black and you're doing autoREMfit. And autoREMfit uses Mr. Black's targets rather than the probe-mic targets. You would sit back and see this perfectly match to target, except it's the wrong target. So this is a concern I think. Now that was the NAL, this is the DSL of which we thought the DSL would be much closer than the NAL. Now this is only one manufacturer, but you notice even the DSL is missing target, the manufacturer fit is missing target by about, looks like maybe seven, eight dB or so in the high frequencies, which is not good. But again, this is just one manufacturer. We don't know what it would be like with other manufacturers and certainly could use some research in that area. Uh-oh. I'm always concerned when Susan Scully shows up. Because she always find those things that I say that just are on borderline wrong. I wonder what Susan has to say today. Uh, Gus, your audience might like to know that we just had a paper on this topic accept. Well great. Great, I've been looking for some research in that area.

For those of you out there, actually it was just accepted a week or two ago. So what I expect that you will see, go to JAAA and click on Fast Track and my guess is, it will be posted there very soon. And I don't know the results or I'd tell ya. But I'm looking forward to reading it. Another issue. Some of the autoREMfits only fit to 65. So you might ask yourself, am I getting a good fit to soft and loud? Usually loud is okay but soft is where it tends, you tend not to have enough gain soft. In conclusion, this is what Todd and I said a year ago. And I looked at it and I thought, you know, I still agree with all this today. So this is sort of, we're calling these recommendations but these really

aren't recommendations to you, the listener, unless some of you work for a hearing aid company or a probe-mic manufacturer. This is sort of what Todd and I thought is the way this whole thing should work. And that is first, you'd have to use the validated prescriptive methods, forget the proprietary stuff. You need the validated prescriptive methods and we need to use the targets of the probe-mic equipment. Because they have been shown to be truer to the NAL than those that are used by manufacturers. Secondly, fit to the REAR targets using an input like the ISTS. Verifit, of course, has its own male speech signal, which is shaped exactly the same as the ISTS. So that's fine too. As best as possible, fit to soft and loud as well as average. And if you do need to use REIG targets, that's part of the fitting method then I think the manufacturer should provide the option that you could select using an average REUG. And then you wouldn't get the bizarre stuff that I showed you on that one slide. So the question you might have is, is autoREMfit a game changer in the world of probe-mic measures. Well, you know, we've been trying to climb this mountain and up on the top there's this reward. Well it's a reward for me and hopefully for anybody who believes in evidence-based practice is that probe-mic is used routinely for verification and in all clinics and offices. You know, in 1984 was when I started doing probe-mic on all my patients, that we were at base camp, that was the Rastronics system. We're about right here today. My best guess is no more than 20 to 30 percent of people fitting hearing aids are doing probe-mic routinely.

So we got a long way to go to make it to the top. Will autoREMfit move it up? You know I really don't know. It could be the people who are already doing probe-mic will just switch over and start doing it with some of their patients. But there won't be new people who are doing verification. I guess only time will tell. So with that I am ready to take questions. Here is a question that I've gotten, I have gotten so often that it's in chapter seven of the Probe-Mic book. And that is, what is your opinion about programming, I don't know if you guys can hear my dog barking. He's downstairs with the door closed and I told him not to say a word for an hour, but anyway, sorry about

that if you hear him. What is your opinion about programming hearing aids with proprietary fitting formula and verifying? Well, common question. I guess my question is why would you want to start a proprietary? And I know your answer. Your answer is well, the rep was here and said that if you start in proprietary there are special things that the hearing aid does and it doesn't do those special things when you start in the NAL. I don't know if that's true or not. I guess if you really want to start in proprietary, but then still fit to the NAL, I see no problem with that. I can tell you that with some products, it might be more difficult to fit to the NAL when you start in proprietary. Because they might use different compression strategies because the proprietary fittings are sort of linear. Where if you're gonna get your NAL targets you're gonna have to use a fair amount of compression. If you start fitting to soft to meet your target for 75, you're gonna have to use a fair amount of compression. More compression than you're gonna find in a proprietary fitting. But yeah, I have no problem with that. To me, oh good, Lisa said she didn't hear my dog. Well Guinness is his name and he has a problem with something, but good. I think I have maybe time for one or two more questions. I think we got a couple minutes left on, the big hand isn't quite on the 12 yet. One of the questions is, what's the downside of just simply always starting with AutoFit and then sort of re tweaking? I think that's fine. Particularly if the AutoFit is using the same targets that you're using. I see no problem with that. And it might clear things up. Oh boy, here's a question that is about a, it might take a long time to answer.

The question is, the difference between the REAR and the REIG and how are the measures different? They're very different. The REIG is based on gain and it's on the belief that what the person, the gain that the person walked in the door with matters. And that is you subtract the REUG from the REAG, to determine gain. If you fit by the REAR, then you don't care about what the person REUG is. You don't even measure it. All you're thinking about is how do I want to place the speech signal at the eardrum. So you're looking at ear canal SPL and what you believe is appropriate for somebody with

that degree of hearing loss. So there are two different thinning strategies. As I mentioned earlier, if the person's REUG is average, then you're gonna get pretty similar findings. But once the REUG starts deviating from average, you're gonna get quite different. I would, and I we've written about it considerably in all of our books and I'd refer you to that. There's like a four-page discussion on it in one of our chapters. But that's the short answer. I got a couple more questions here I want to get to before we run out of time. How does the adjustment of loud sounds affect the soft and average? Well, let's say that you're in a, here is the way I would suggest programming your hearing aids. Forgetting about AutoFit for a second. You first fit the soft, then you fit the loud and my best is average is gonna be just about right. I know however, there are some people, who do loud last. And here's how it would affect it. Let's supposed that you have a nice fit-to-soft, you have a nice fit-to-average, and now you go to loud and loud is too loud. How are you going to impact that? Well the only way you're gonna impact that is increase the compression ratio. Now in the old days, by old days, I mean 10 years ago. We actually went to the compression, ratio tab and changed it from 2.2 to 2.8 to 3.1 or whatever. Now there's a little tab probably that says, loud sounds too loud. And you don't even know what you're doing maybe. But I can tell you, you're changing the compression ratio. Well if the knee-points 45 and you're changing the compression ratio to get loud, softer, 65 is also above that knee-point. So you just make 65 softer. So by changing one, you're changing the other.

Now if your hearing aid has multiple AGCI knee-points and there's a knee-point up at 65 then you might be in luck because then you could just the ratio for, you could change the ration for the high end and you could pull loud down without altering. Which is why, I would say again, my recommendation is to fit to soft first, then fit to loud, and my bet is that average is almost always gonna fall right in the middle. Because guess what, 55, 65, 75, 65 is right in the middle. Okay, let's try one more and then I think it's closing time. Thoughts on how the white x sensor gram plays into all this? You know, I've never used a sensor gram. The sensor gram basically corrects for

the patient's RECD. So could you use, unfortunately White X doesn't have an Autofit procedure that I know of. So I don't really know. If you could somehow use sensor gram thresholds and then do an AutoFit, I don't know. I think you'd have to ask somebody from White X specifically. I don't have a good answer and I don't want to say the wrong thing. So our moderators here, are we ready to wrap this up?

- We will. Thank you so much Gus. Doctor Mueller, we appreciate your time and your presentation. Really great information to provide everyone. I want to thank you all for joining us today. Just take one second to remind you of another Signia expert series that's taking place on August 28 at noon eastern time, by Doctor Tom Powers. And he will be presenting his course, E-Audiology: Patient Engagement. We hope you all can join us and have a great rest of the day.

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