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Real-Ear Measurements: Ensuring Precision in Hearing Aid Fittings

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You.

Hello everyone. My name is Dr. AmandaWolfe, the Manager of Learning Enablement on Starkey's Education Training team. I am very excited to be here with you today to provide an overview of relayer measurements and share how you may implement them in your clinical practice. But first, some housekeeping. If you would like to ask a question, please do so by using the Q and A feature.

We do have a lot of content to cover today and there are a number of you online, so I do have a colleague online with us today that will do her best to answer questions as they come in throughout the presentation. Handouts will be available under your pending courses on Audiology Online or by clicking on the link in the chat. In the classroom, CEUs are available with a paid Audiology Online unlimited CEU Access membership. After completing the course, you can go to your pending courses and take the multiple choice exam and then claim that ceu. And lastly, if you need any technical support, you have the option to call, email or use the Q and A window for assistance.

On this slide you can see the risks and benefits that may be associated with this course.

All right, now we have three learner outcomes for today's session. After this course, learners will be able to explain the benefits of utilizing related measurements in their clinical practice, learners will be able to describe how to prepare for real ear measurements, and learners will be able to describe the basic real ear measurement process.

We know that performing relayer measurements contributes to higher patient satisfaction since it tailors the fitting to individual ear differences and has actually been noted as part of best practice guidelines when it comes to verifying hearing aid performance from organizations like the American Academy of Audiology and the American Speech, Language and Hearing Association.

That said, as you know, not all clinicians have access to relear verification or utilize it routinely on every patient. In a 2006 survey of dispenser sensors, 57% of survey respondents reported owning relayer equipment. However, only 34% reported using it routinely. Now, we can speculate that some reasons for low relayer usage may be simply lack of time space constraints or practice setting constraints, such as audiologists who are traveling to their patients. The most recognized goal of performing relayer measures is to verify the audibility of the speech signal inside the ear and the output of the hearing aid while everything is seated and in place.

Some professionals out there may be unsure of the value of relear measurements and say that their patient report is all they need to verify audibility and comfort. And yes, behavioral reports from your patients are extremely important. Important. However, we've all had those patients who either are not strong advocates for themselves or who are just not very good at verbalizing their experience with hearing aids. So real ear measurements may be used to obtain an objective measurement of hearing aid efficacy and used in conjunction with self report measures may help support overall patient benefit and may help make your time in your clinic more efficient.

The goal of a hearing aid fitting is not simply to make sounds louder. The goal is to make speech audible, comfortable and safe while accounting for the individual's hearing loss. This raises a key question how much amplification should be provided at each frequency and input level? That's where fitting formulas come in. Real ear measurements tells us whether the hearing aid is delivering the prescribed amplification in the patient's ear, but the fitting formula determines what that prescribed amplification should be.

A fitting formula is an evidence based prescription that converts an audiogram into amplification targets. They use research on speech intelligibility, loudness perception and listening comfort to estimate the gain that will provide the best outcome for a patient. There are your more generic or

commercially available fitting formulas such as NALR, NAL1, NAL2 and now NAL3 and then of course DSL. And then there are proprietary fitting formulas that are developed by the hearing aid manufacturer and are specific to their hearing aids such as Starkey's proprietary fitting formula estat 2.0. NALR stands for National Acoustics Laboratory Revised, which was one of the first standardized evidence based fitting formulas.

It's a linear fitting formula of which many future nonlinear compression formulas are based upon and utilizes a loudness equalization rationale I.e. all frequency bands of speech will be amplified equally and equally contribute to the overall loudness of speech.

NEL 1 stands for National Acoustics Laboratory Nonlinear Version 1 created for nonlinear hearing aids. This rationale maximizes speech intelligibility and keeps overall loudness at a level no greater than that perceived by a normal hearing person.

An NAL NL2 came out some years later and incorporated user specific variants, variables such as gender, language, hearing aid experience and cultural preferences. As a result, this formula provides less gain than NAL1 did and some of you may have heard. NAL NL3 was released last year. This is the next generation of hearing aid fitting prescription developed by the National Acoustics Laboratories and was built on years of research providing a more accurate, data driven and patient centered approach to hearing aid fittings. Earlier formulas were based on clinical research involving hundreds or thousands of people, whereas NAL NL3 is built on a foundation of millions of hearing aid fittings enhanced by machine learning driven analysis, real ear measurements, and in the moment user feedback.

This is the National Acoustic Laboratory's most personalized and precise fitting formula to date.

And lastly, DSL was developed in the 1980s out of the University of Ontario for pediatric fittings and stands for Desired Sensation level. Essentially, the latest version of DSL employs extended protocols

and more flexible targets based on the information provided about the child, such as age and etiology of hearing. This rationale most closely resembles a loudness equalization rationale like nalr because with children depending on the age, they're still of course developing their speech and language and need to hear as much as possible. Most of us think of this as a pediatric formula, but it has been updated to include adult targets and again it is correlated with data on preferred listening levels and the goal is to normalize loudness and provide that maximum audibility.

So I'm assuming a majority of you fit multiple manufacturers in your day to day practice. Now, if you fit a patient with manufacturer A and then fit the same patient with manufacturer B, would those gains be the same if you used the same fitting formula? The answer is probably not. While universal fitting formulas like NAL2 and DSL, for example, were developed to be used in the fitting of technology by multiple manufacturers, that's why they call them generic they do not account for manufacturer specific approaches to signal processing. Here you see relay responses using NAL NL2 with hearing aids from four manufacturers using the same hearing loss, receiver matrix and acoustic options.

You can see differences though in the responses as a result of each manufacturer's unique approach to signal processing. So you can see that equivalent hearing aid responses are thus not possible and we wouldn't necessarily be aware of the differences without running these real ear measurements.

So before we go any further and start talking about the actual process of real ear measures, I want to pause and make sure we're all on the same page regarding real ear terminology so you can follow the rest of today's presentation. If you're just getting started with Real ear, there is a lot of information out there and if you do even a basic search of what REAL is, you will quickly be inundated with a slew of terms you need to be aware of. In fact, it can be easy to get lost in a sea of acronyms when it comes to the topic of relear. So before we get to how you will perform them, you need a basic understanding of the terminology associated with these measurements. Now, I don't have time to review all of these

definitions or measurements today, but these are easily searchable on the Internet.

If you would like to learn more. But let's jump into a few definitions though to get you started. So if you notice on the slide before some acronyms ended with an R and some ended with a G, those are important designations that stand for response and gain, respectively, and are two ways of viewing the same information. The term response, also known as output, indicates the clinician is observing the absolute measurement of sound pressure generated in the ear canal or the output of the hearing aid. As we all know, the amount of amplification provided is called gain and is expressed in decibels and is your output minus your input.

Practically speaking, out of all the acronyms I just showed you, you will likely mostly perform rear in the clinic. Real Ear Aided Response this is a measurement of the SPL in the ear canal created by the hearing aid when it is turned on and placed in the ear.

Reag is the rear minus the input signal.

The last term I'd like to review is the SII. The Speech Intelligibility Index, or SII is a measure ranging from 0 to 0 sorry, 0.0 and 1.0 that is highly correlated with the intelligibility of speech. The SII score is a way of quantifying the likely intelligibility of speech based on the proportion of speech cues that are audible. It's a quantification of the proportion of speech information that is both audible and usable for a listener. So Basically, an SII of 0 implies that none of the SPE in a given setting is audible or usable to improve speech understanding, whereas an SAI of one implies that all speech information in a given setting is both audible and usable for a listener.

So as the SII value increases, speech understanding generally increases. The method for calculating the SII is described in the ANSI S3.5 1997 standard titled American National Standards Methods for Calculation of the Speech Intelligibility Index. If you would like to learn more about those specifics so

we'll talk more about SAI later as it's a great counseling tool you can use when actually running your measurements.

Now that we have some terminology under your belt, let's switch gears and start reviewing how to run real ear measurements on your patients, which I'm sure is why most of you are here. For the purpose of keeping things simple, I'm going to focus on the audioscan Verifit Real Ear Measurement System, specifically their Speech Mapping test, which is the test used for your real ear aided responses using a speech signal. Now in my clinical experience and that of other professionals I spoke to, speech mapping or its equivalent on other real ear equipment is the primary measurement done in clinical practice. Now, while I'm going to be focusing on the Verifit system, know that if you're using another system, the steps may differ slightly depending on which relayer equipment and company you are using. So it's important of course to read your respective user manuals before using the system.

Also, please know that Starkey nor I are endorsing the audioscan VeriFit. It's just the equipment I personally am most familiar with.

So with the Verifit system and similarly with other systems, there are a few setup steps that need to be done prior to running the measurements. You need to calibrate the system, of course. Enter in your patient's audiogram, select the fitting formula you wish to generate, targets to and match to select the device type and coupling of your patient, the stimulus you would like to use, where you need to place your actual patient, where you need to place the on tube. Probe tube placement needs to be consistent. You need to set up the hearing aid and then verbally prepare your patient for the upcoming measurements.

So let's break each step down Calibration compares the frequency response of the probe tube, which is the tube that sits in the patient's ear and picks up the signal in the ear canal, to the flat frequency response of the external reference microphone, which maintains the appropriate stimulus level at the

ear and compensates for this difference in all subsequent measurements. So by calibrating, we're essentially making the probe tube and the microphone acoustically invisible. Some equipment will have you calibrate before each patient and some will store the calibration. In other words, you could calibrate every day or every week and that data will be stored so you don't have to calibrate before each individual patient. But your user manual will explain what your equipment supports for the verifit.

Calibration may be conducted daily or weekly, which can be selected by you in the calibration menu in the settings. And this actually makes it really nice so you don't have to calibrate again prior to each patient. And don't worry if you forget, the system will prompt you to calibrate before any measurements can be conducted. So to set up for calibration you would simply align the external microphone with the probe microphone like you see in this picture here and again similar with other systems. Then you would hold the probe dock 6 to 36 inches away from and directly in front of the equipment speaker with the microphone to be calibrated facing the speaker, and you would select the button that says calibrate.

This will elicit a stimulus from the speaker like a white noise stimulus, and a trace will appear on the screen that you can compare to the expected response, which is likely displayed in your respective equipment's user manual for reference. For the verifit, the resulting curve should be similar in shape to that shown here, but it could be shifted by plus or minus 5 dB. Excuse me.

Next, you'll need to enter in your patient's audiogram, of course, to generate the appropriate prescriptive fitting formula targets and select your fitting formula. Now, I recommend for the most accurate results, either matching the fitting formula you have selected in your manufacturer's fitting software, or if using a proprietary fitting formula, select the one that most closely approximates it. You may have to reach out to the hearing aid manufacturer you are working with to see which formula they recommend based which formula they recommend, and maybe base theirs on. So at this time, and to my knowledge, no real measurement systems include hearing aid manufacturers proprietary fitting

formulas.

Next step would be to select the type of hearing aid your patient is wearing and whether they are open, fit or occluded, and I'll tell you why this is important. Sound field equalization corrects for the inherent instability of the test environment due to movement, sound reflection and diffraction. The type of equalization that occurs will depend on your fitting and whether you have selected open or occluded. For open fittings, the sound escaping the ear canal from the hearing instrument may actually be detected by the reference microphone, which could alter your measurement. As you recall from earlier, the reference microphone actually adjusts the signal at the ear accordingly, so the intended presentation level at the ear is accurate throughout the whole measurement.

So if open is selected, the reference microphone is actually turned off during your measurements to prevent this potential underestimation of hearing aid gain due to that leakage from the ear canal. For the first measurement, you will be prompted by the Verifit system to mute or turn off the hearing instrument, and then you would click the Equalize button on the Verifit screen. Now, it actually won't run the test measurement until you select Equalize, so don't worry about missing that step. This will elicit a stimulus similar to the calibration stimulus. Then you can unmute or turn the hearing aid back on and continue with your measurement.

Now, because the reference microphone is off during all measurements, it's important your patient remains still to keep the stimulus level as consistent as possible. Now, when occluding is selected, the sound field equalization is concurrent, which means it occurs automatically between each test measurement. So while it's still important your patient remain as still as possible during the measurement, the reference microphone will remain on, so it will be adjusting the stimulus level as needed throughout the measurement.

Next, you'll need to choose your stimulus from the list of options your equipment provides. I recommend using a speech stimulus. Here are the most popular stimuli available and are all intended to represent the average speech spectrum. I use ISTs, the international speech Test Signal for the relear aided response that rear. It was developed from recordings of six female talkers speaking the same passage in different languages.

Those languages are American, English, Arabic, Chinese, French, German and Spanish. The segments of speech were then spliced together and filtered to match the average female spectrum. I use ISTs for the rear because it has certain dynamic properties that make it very similar. Real Speech the ICRA stimulus comes from the International Collegium of Rehabilitative Audiology and is actually a distorted speech signal which is a random type noise modulated by speech. And the caret passage may be the most familiar to some of you who have had some experience with real ear or remember from your schooling.

It is a 10 second long audio recording that talks about a caretaker.

Your relayer measurement system user manual will likely recommend positioning the patient directly in front of and facing the speaker at a distance of about 18 to 24 inches, with the speaker at the same height as your patient's head. Ideally, the room you have your relayer equipment in should be conducive for acoustic measurement as much as possible. This means the room should be quiet with minimal hard reflective surfaces. Also, the equipment and thus your patient should be as equidistant as possible from walls and other large surfaces to minimize standing waves. That said, do the best you can with the equipment and environment you are working in.

So once your patient is positioned, hang the external microphone over the ear with the probe tube attached. The probe doc like you see here. Now you'll need to put the probe tube in the ear. Now the probe tube is used again to measure the response of the hearing aid at the eardrum. So I always

recommend doing an otoscopic exam before inserting the probe tube, even if you've already done it earlier.

This will help you again get the lay of the land as far as the ear canal is concerned and make sure there's no cerumen to take out before putting the probe tube in Cerumen can plug up the probe tube very easily. So if the patient has some that you feel can be removed, go ahead and simply remove it. If the probe tube is blocked by cerumen, this will restrict sound from reaching the microphone and you would actually see the output curve unusually low once you start to actually run your measurement. If you feel this is the case ever, it's best to just remove the probe tube, replace it with a new one after clearing the cerumen from the ear canal. Do not, under any circumstances, use the same probe tube on multiple patients that you see throughout your day.

Even if you feel like sanitizing is okay to do, always use a fresh probe tube on each patient. Because it's a tube, you never know what's made its way into the tube. So as far as how deep to put it in the ear canal, let's look at how we do that. It's recommended that the probe tube sits between 2 to 5 millimeters from the eardrum to avoid standing waves. To help you with insertion, the probe tubes that ship with your equipment should come with a black like little marker around the tube.

It almost looks like a little rubber band that indicates it's pre measured a certain amount. Generally speaking, the marker should be placed approximately 28 millimeters from end of the probe tube for adult females, approximately 30 millimeters from end of probe tube for adult males, and approximately 20 to 25 millimeters from end of probe tube for children who are actually able to sit still and quiet long enough to perform real ear measurements. Keep in mind, all of these positions may be modified based on your otoscopic examination as well. And also check your probe tube packaging. It may have a measuring tool included which you can use pretty easily to measure the correct length for your patient.

So once that black marker is measured, it can actually be modified a little bit. You can insert the probe tube in the ear and generally the black rubber piece should be sitting right at the intertragal notch or even a little deeper. Now, it's important to be very careful when inserting the probe tube and to make sure it doesn't slip in deeper. When you put in the hearing aid, ear mold or earbud, it's already sitting very close to the eardrum, so it doesn't take much for it to slip even deeper and potentially poke the eardrum, which is not very comfortable. So when I'm doing it, I'm sure to hold the probe tube in place while I'm inserting the device with my other hand and to help you with insertion Some relayer systems out there have built in tube placement indicators and progress bars to ensure consistent and proper placement for each patient.

So I also wanted to share a few other tips while we're on this topic. Some patients may start to cough seemingly out of nowhere during probe tube placement. This is due to a nerve that runs through the ear canal. So sometimes the probe tube can irritate that nerve as it's being inserted and cause your patient to cough. So just be forewarned.

Other patients may experience some tingling with the probe tube insertion and may be kind of jumpy while you're doing it. So all things to be aware of and ensure you have a good hold on that probe tube and properly instruct your patient. Now one other thing I wanted to mention here is that sometimes with the probe tube inserted, the ear mold or hearing aid may be too tight of a fit and may actually pinch the probe tube and your measurements won't be accurate. In those cases, if the fit is too tight, it's okay to put the the probe tube through the vent if there is one. Now to identify that in your measurement you would see again maybe a reduced output on your screen or I've seen where the high frequencies are sharply cut off.

So just something to keep in mind again, if you ever feel like your output curve is not quite right, then just simply take out it, take out the probe tube, either reinsert it, try another probe tube and start over.

But again, if you ever see a lower curve, kind of a sharp cutoff in the highs dips where there shouldn't be a dip, maybe try and redo the measurement measurement. So after you've done your measurements, be sure to dispose of that probe tube as they again should only be used once. It is very important you use a new probe tube for every patient. If you're ever unsure, maybe a colleague left some probe tubes on the counter, just toss them and put new probe tubes on.

It's also a good idea to go into your programming software and adjust the hearing aid settings. So while relayer system should be compatible with all forms of hearing aid processing, it's recommended to limit signal processing during testing. So for our rear I set the hearing aid to omnidirectional mode and I turn off noise reduction features and even the feedback canceller if possible. Pretty much any adaptive feature your hearing aid manufacturer has turned on should be turned off. This is just to ensure that while unlikely, the hearing aid isn't doing something to the stimuli that would alter their response and give you inaccurate data while you're trying to match targets.

You also want to ensure the input levels from your fitting software match or are approximated to the levels you wish to measure with your relayer equipment. If the relear system does not have the same levels, choose the level that most closely matches that. Typically, we want to measure multiple levels to ensure soft speech is audible, average speech is comfortable, and loud speech is loud but not uncomfortable. So running an MPO curve maximum power output will also help ensure the hearing aid output will stay at or below the patient's ucls. If you didn't measure ucls during the hearing test, your relayer equipment may have an option to use at average values.

And the final step I always recommend doing is instructing your patient to remain quiet and sit still during all the measurements. We do want the most accurate data possible, so we don't need other inputs coming through the hearing aid other than the chosen stimulus. And we don't want the probe tubes moved from their position. I always let my patients know that they will be listening to a speech

signal at different volume levels, and all they need to do is sit still and look straight ahead. Because our patients have likely experienced, well, not likely.

They've all experienced hearing tests before, they may be apt to repeat back what they're hearing. So I always like to remind them that they don't need to repeat back anything or even understand what is being said in case you're using the ISTs, for example, with those multiple languages. And as you know, some patients are more sensitive to louder sounds than others. So I always let my patients know that if at any time a signal gets uncomfortably loud, they just simply need to raise their hand and I'll stop the measurement. I have had this occur during my loud measurement and sometimes with my MPO measurement as well.

So you can either change the level of the loud stimulus so it's a bit softer, or choose to not run it at all, depending on your clinical judgment. Generally speaking, though, even if I reinstruct the patient like, oh, let's try that again, I know it was a little loud. They do okay the second time around now that they know what to expect. And I haven't had any issues getting my measurements done. So now what?

You're set up and you're ready to run your measurements. So let's walk through what that means and what you're looking for at that initial fitting. Of course, again, what we'll review today are all just suggestions. As you get more comfortable with doing realeader, you can adjust your protocol to fit your needs and the needs of your practice. So looping back to the Verifit system, once you're on that speech mapping screen, you'll see something like this.

Now, to keep things easy to view, we're just looking at the left ear, but you do have the option of seeing both ears if you want to. So to enter your patient's audiogram manually, you would select audiometry in the upper right. This is also where you would select your fitting formula and a few other items. If you have the ability to transfer the audiogram via your fitting computer and the audioscan module, the thresholds can be transferred, but you will still need to go here to select your fitting formula and again

those other options. So now you'll notice there are four Oops green play buttons.

Generally, when people run real ear with a speech stimulus, they're interested in seeing relayer output of the hearing aid for those multiple loudness levels. A soft speech level like 50 or 55, average speech like 65, and maybe a loud speech level like 80. So each line would be used for those each individual measurements as you'll see here in a minute. Once you hit Play, you will have the option to select your input levels. Usually I start with the soft level as the first test, then do average and loud.

So each curve will be a different color, so it's easy to tell the difference. I try to match up the input levels I select on the relayer system with the input levels in my fitting software. As I said earlier. So once you select Play, you will see the fitting formula. Targets automatically generate and the relayer aided response curve will appear on the screen.

The targets here for this example are what is labeled number four on the screen and look like little T's. The response curve is labeled as five on this screen and is a solid curved line surrounded by that aided speech banana. Now, the goal here would be to increase or decrease the gain of the hearing aid in those different frequency regions to match the targets for each input level. The image on this screen is of course the perfect match to target, but generally your goal would be to match within 3 to 5 dB, keeping your patient's comfort in mind. So if you find that increasing gain to match target is uncomfortable for your patient, or you hear feedback from the hearing aid, it's best to stop there.

And the blue line is your patient's audiogram in spl. So that's why it's flipped based on what you're used to looking at on the traditional audiogram. So everything above this line is audible. Everything below this line is inaudible level. Remember, the best hearing aid for your patient is one they will wear.

So doing real ear and matching to targets are a balancing act between comfort, audibility and sound quality. Keep your patient's comfort in mind as you're doing this, especially with those louder curves.

Now, there's one other thing I wanted to point out on this screen and that is what is labeled number eight. So within the speech map display screen, the predicted unaided and aided speech intelligibility index scores appear for each of the tests you may be doing. For ease of understanding, the verifit displays these values as a percentage.

So while not labeled, the predicted unaided SII is 33. Here on this screen, an unaided SII will be predicted for each input being tested and an aided SII will be below it, which is designated again as number eight and then will appear after you run each measurement. So in this example, the input level is 65 and the predicted unaided SII is 33. The aided SII right below it is 74. So as you run your relayer measurements, you can very quickly and easily see your SII score and relate that to your predicted speech intelligibility.

So this figure on the right of the screen shows expected percent correct speech recognition scores versus SII values for normal hearing individuals. When using a variety of speech recognition materials, the various lines are showing that small improvements in SII score yield big improvements in actual word recognition score. But at some point we reach a ceiling effect where further improvements in SII have very little impact on word recognition. So this is where we can see the slope of the lines kind of start to level out. For the word discrimination test that begins about an SII of 70.

So looking at the table, it's a bit easier to read. If you're wondering what SII to shoot for, it's worth trying to get close to 70 for conversational speech because up until that point, any improvement in SII will have a positive impact on word recognition. But if you try to push it past 70, those word recognition scores will start to level out. Now, while the SII is a great tool for you to use as a professional, it's important to keep in mind a few things. One, each fitting formula prescription has been designed and evaluated to provide comfortable loudness and good speech recognition and fitting higher than the gain targets in order to get a higher SII may make things too loud.

Also, as hearing loss becomes more severe, your SAI expectation needs to go down. Also kind of think about real world context too and how speech Recognition in the real world will likely be better with contextual cues, facial cues, et cetera. So take SAI with a grain of salt and certainly think of it as a starting point, but don't get too caught up with increasing gain to reach that specific value. So, switching gears away from SAI a bit, let's look at the rest of the available information you'll see on the screen. Again, generally, it's best to run three different speech levels and then run that MPO curve to ensure the maximum power output of the hearing aid is on.

Encroaching on your patient's ucls. After you run multiple measurements at different levels, this is what you'll see. So, starting with number one, these are your MPO targets that are automatically generated. Number two are the estimated uncomfortable loudness levels from the verifit. But again, you do have the option to enter in those measured UCLs.

Number three is the measured MPO curve that I typically run last. And this is a series of loud beeps. So your goal again here is just to ensure that MPO does not exceed the UCL values of your patient. And this is a great opportunity to get your patients involved as well. When you're presenting this sweep at, you know, 80 or 85, you can instruct your patient to raise their hand if any of those beeps are uncomfortably loud.

That'll clue you in on whether or not you possibly need to reduce the MPO in a certain frequency region within the fitting software. Number four is the average curve for this measurement, and in this case, a measurement of 65dB spl. Five is the 50dB curve and six is the audiogram, again in split. So now that you're prepared for what you'll see, let's take a look at what a real measurement looks like. Now, in the real world, you may find that everyone has a different protocol based on their philosophy.

I'll review how I've seen many other professionals do it. Just so you have some baseline knowledge at that initial fit, I recommend setting the device to its initial fit response, programmed by your hearing aid

manufacturer's fitting software and running measurements to see how close you are to target. So I call these your pre adjustment measurements. Let's take a look.

Now, I can adjust the hearing aids for each input level in my fitting software and rerun the measurements. You can always do this while your measurements are actively running. But getting started, it might be good to run your pre adjustment and post post adjustments. So again, my goal is to match within 3 to 5 decibels, within the range of 500 to 4,000 hertz. So let's see where we ended up.

It.

And if I were to.

All right, so now that I've matched to targets, let's take a closer look at those SII values. We see the unaided SII scores which were kind of what you may expect for each input level. And then after running the measurements, we see the aided pre adjustment scores.

Then after we make adjustments to better match target, we see a further increase in SAI scores. So again, even at target we still aren't reaching that 70% SII SC soft and average inputs. But again, your overall goal is for improved speech recognition, again keeping those real world context things in mind. So now that we've talked about how SII helps quantify speech access, the next question becomes how do we gather the verification data quickly enough to make it practical? In Starkey's Profit software, professionals have access to REM Target Match, which is a feature that offers a streamlined process for automatically matching relay or target targets for you to provide accurate and an efficient fitting experience.

It is fully integrated into the Profit software and allows you to perform binaural real ear measurements and automatically match your hearing aid frequency response to even prescriptive fitting formulas as

well as allows you to manually fine tune the response. It's compatible with popular REMS systems including VeriFit 1 and 2, the Med Rec Savant Interacoustic Affinity Suite, Inventus Trumpet and the Oracle Free Fit. Our clinical research team has shown REM Target Match to significantly reduce fitting time compared to traditional measurements while maintaining speech intelligibility index, ensuring an optimal fitting for your patient. So let's watch a quick video of this process. This is using our REM Target Match simulation feature.

This is an excellent feature you can find under Product Simulator in the Profit software. You would simulate any product and you would within the software select REM Target Match. So this will guide you through the process. So here I'm going to select REM Target Match. I'm going to launch my REM system which just simply means it's going to detect the REM system going to calibrate within the wizard here.

Again, this might differ slightly depending on which system you're using. Do that unaided response.

And then we'll do our aided auto adjust. We're first going to select our max sound level, which is where the system would automatically stop if needed. We're going to select which input levels we'd like to measure and hit start.

So here we're running each measurement. As you can see, it's much faster than traditional relayer measurements. This is our pre adjustment. Then we're going to move into the post adjustment which it does automatically for each input level.

And then we also allow you, well as the clinician to tweak if you want to using this fine tuning table so you can tweak within any frequency range you wish. You can undo the manual measurements and also skip if you feel like the curves are okay.

And then as we exit the wizard, we'll now see that instead of predicted relayer on that vertical axis, we now say measured relayer or measurement based relay. So a few tips and tricks I want to make you aware of. If you use a verifit system and calibration has been completed daily or weekly, that calibration prompt will be skipped and you can just go straight to aided measurements if you skip. If you all saw that little man in that video during that Verifit2 demonstration, that's called the binaural sound field assist. If you choose to to skip that feature, you will need to run measurements monorally.

That just ensures the patient is centered. So if they're not centered and you skip it, you'll just have to run each ear individually and then specific to verifit systems and specific to NAL2 bone conduction thresholds must be entered at 500 and 2000 Hz or the system will fail to launch and you won't be able to run your measurements. So when you're running your measurements, know that REM Target match will always Target match to Experience level three. If you have that experience level set to something less than 3, rem target match will adjust that gain to match that experience level. After that target match is complete, once you exit the REM Target Match tool, there is not a way to access it again.

The access the curves again. If you re enter, we'll just assume you want to make new measurements. So printing the fitting report graph is recommended before closing. And then for those of you who use noaa, make sure that the measurements are visible in your fitting report. You can do that by turning on NOAA fast data by going into Profit Preferences General and select NOAA FAS data.

And then as you saw in that demonstration video, you may select the loudness level at which the system will automatically stop measuring prior to beginning. So it may be useful to align the max sound level with those UCL measurements.

Also, the ADEN measurement is always going to be completed at 65 dB. However, all three input levels are adjusted during this measurement. If you click on Input levels. As you saw in that video, the average 65 dB SPL curve is the default view. As you saw it was kind of grayed out.

To see more curves you would simply check mark the 50 and 80 DB SPL curves.

Now, in my experience with seeing other audiologists run real ear measurements at the hearing aid fitting, each have their own protocol on what works well for them and their personal fitting philosophy or their clinic's fitting philosophy. I've seen professionals that will match to TARGET at the first fitting and then not make any further hearing aid adjustments at all during that appointment. They really focus on encouraging their patient to acclimate or get used to those gain settings over time between the fitting and usually the first follow. Then at the follow up they would make those adjustments if needed. On the other hand, I've also seen professionals who will match to TARGET and then after speaking with the patient for a bit will make hearing aid adjustments at that same appointment based on patient report.

So some of you may ask what's the point in doing real ear measurements and matching the target then if you just make hearing aid adjustments away from target afterwards, whether at the fitting or at the next follow up? Really the point is matching to target first will give you a great research based starting point for gain settings based on your patient's audiogram and other information. And if you ever veer away from that to achieve patient satisfaction along their hearing journey, you at least know that you have verified the fitting based on best practice guidelines. You may also match the target at the initial fitting and always rerun relear measures at a later time to get their final settings. So comparing SII values along their hearing journey may also provide insight into their reports from their real world environments.

And if you find that after adjustments have been made and perhaps SAI has gone down, you can better counsel your patient if they find they're struggling. Also, no matter if you choose to run traditionally or use something like REM target match, it's important to remember that in conjunction with relear measures, you also need to utilize other tools to help you understand your patient's needs for both audibility and sound quality. So to do this, some of you may give your patient questionnaires to fill out,

or you may choose to simply chat with your patient on how things went since you last saw each other. As hearing professionals, we have to make sure that not only is speech audible, but that our patients are satisfied with their hearing aids. And the best way to do this is to make sure that we're reaching that balancing act between audibility and sound quality.

So at this point, we know the utility of real ear measures and we know that every patient is so unique. Just because we're making speech audible, it doesn't mean that the patient is going to be able to interpret it. But if it's not audible, then there's no chance that they'll understand it it. So we're working on this balancing act of making speech audible, but also making it sound and remain comfortable. And we also need to balance the time we have for the fitting, of course, with the time we have for counseling.

Performing real ear measures gives you a real time view of hearing aid output in your patient's ears, so it may actually save you time counseling, since it may take some of the guessing out of the equation. So like our profession in general, all of this is really not only a science, but also an art.

But that balancing act, or those balancing acts that I mentioned can really pay off. I know that most of you joining me today likely already are convinced of the benefits of relayer measures measurements, or you're at least curious about them. That's why you signed on today. And so you just wanted maybe a review of how to run them or a little refresher. But I wanted to reiterate quickly as we wrap up the why behind measurements, there is research to support the idea that patients do report greater perceptual benefit when their hearing aids are adjusted according to relayer measures as compared to when relear is not run at all.

They also report reduced listening effort, improved speech understanding, and come back for fewer follow up visits.

The most important thing to keep in mind is why you're running realir measures in the first place. How do you want to use them? How do you want to make them meaningful to you? And remember that verifying audibility is so important, but it can also just be the starting point in the fitting process. Your patients are so unique and your ultimate goal is to find a balance between speech intelligibility and patient acceptance.

And by combining real ear measures with reports of real world performance and other validation measures such as questionnaires, you'll be able to provide the most comprehensive hearing care for your patients.

I want to thank you for your time today. If you want to learn more about the value of verification, there are a plethora of resources available online, but you can start your search on either the American Academy of Audiology website or the ASHA website. And for more specifics on the verifit. In general, the user manual is open access through a simple Google search or we made a convenient QR code here for you if you'd like to do some of your own reading.

I have several references I use today if you are interested in viewing and doing a little reading on your own time.

Again, thank you so much for spending part of your day with me. I really do appreciate your time and attention. If there's any questions we did not get to today. We we will certainly follow up. Thank you so much.