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Hearing Aids for Children and Teens: Tips and Tricks for Successful Fittings

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- [Dave] Good day, everyone. And thank you for joining us today. My name is Dave Gordey and I'm the Director of Pediatric Audiology and Research for Oticon headquarters in Denmark and today, I'm coming to you from my home in Toronto, Ontario, Canada. So welcome to Hearing Aids for Children and Teens, Tips and Tricks for Successful Fittings. Let's start by reviewing our learner outcomes for today. After completing this course, you will be able to describe the importance of RECD measurement at assessment and for the hearing aid fitting. You will be able to describe how DSL targets inform our hearing aid fittings for children and you will be able to describe the benefits and limitations of open fit hearing instruments for children. So you know the lives of children with hearing loss have changed significantly over the past 10 years. And there's some major reasons for these changes. So because of newborn hearing screening, babies are being fit with hearing technology, better hearing technology, which means more access to auditory information, and therefore giving more opportunities for good speech and language development.

Also, many of us are now working within models of evidence-based practice, where guidance is provided and how we can provide the best possible outcomes for those individuals with hearing loss. The other big shift that we see is that the majority of children with hearing loss are being educated in their neighborhood schools alongside their typical hearing peers. So this is wonderful, isn't it? Lots of great changes and a lot of great advancements. So as a member of the KIPA Group, and the KIPA Group stands for Knowledge and Implementation in Pediatric Audiology. We are a group of researchers, clinicians, whose aim is to understand the challenges pediatric audiologist might face when trying to implement these evidence-based practice guidelines. So today's presentation, I'm coming to you today really as a knowledge broker to share with you some strategies around providing successful fittings that have been shared with the KIPA Group based on those experiences from pediatric audiologist in North America. So if you have not joined the KIPA Group, I have put the website here on the

screen kipagroup.org and you're welcome to go there and sign up. By signing up for this network, you will be invited to member only webinars as well as being given the opportunity to participate in research projects. So let's go ahead and begin with our very first tip. So since 2010, when the KIPA Group began its first meetings, we've been having a lot of really interesting conversations about the use of Real-Ear-to-Coupler Difference and its role in pediatric audiology practice. So before sharing this tip around RECD, let's just quickly review what we mean when we talk about RECD. So this is the difference between the SPL measured in the patient's own ear and in a two CC coupler produced by a transducer producing the same signal. So in other words, it's composed of these two measurements, a two CC coupler measure and then the real-ear probe tube measure and these two measurements are compared with one another.

So the reason why we know real ear to coupler differences are important for children is that the RECD data is entered into the hearing aid software helps us generate fitting targets. Next, fitting hearing aids to targets for gain and output is really what gives us our best starting point to provide good speech information to children with hearing loss. And we also know that the RECD should be completed every time a child gets a new ear mold as a new ear mold indicates a change in their ear canal size, and thus an opportunity to update our measurements. So I'm not sure if many of you cringe when you think about trying to measure an RECD on a three-year-old child. For myself, when I was working clinically I was not a fan of making young children cry as I attempted to insert a probe tube and then their ear mold into their ear canal. So really our first tip today is to facilitate confident insertion of a probe tube into a child's ear. So by securing the probe microphone with surgical tape to an insert earphone or an ear mold, we can get the proper insertion depth and therefore we can ensure it is not going to move around. The probe tube is premeasured based on the child's age and then marked at the outer portion of the ear mold or the insert earphone as these two images show. You may be tempted to try and thread the probe tube through event in the ear

mold. But I do advise you to resist this urge as when a tube is inserted through event we are not able to see whether or not is being compressed and this certainly can affect our measurement. So while the RECD is a well known component of the hearing aid fitting, it also has a very important place during hearing assessment. So our second tip around using RECD, is to use it at the assessment stage to help us correct our HL audiogram. So why do we need to do this? Well, children's ears are changing rapidly, particularly during the preschool years, and children with their smaller ear canals may have their hearing levels overestimated when using typical sound booth measurements. The RECD along with the measured HL audiogram can be used in ear verification system, like the Verifit to generate a corrected audiogram with real ear corrected hearing levels. This is likely going to be done by doing an RECD with the foam tip, since we likely do not have an ear mold made at this stage. So, in this depiction here I've plotted an HL audiogram and a corrected HL audiogram after the RECD has been applied.

So the x's in this case are depicting the HL audiogram that was measured in the sound booth with insert earphones. And the circles are reflecting the corrected HL audiogram, which was, had RECD applied and those corrected HL thresholds were available in the Verifit. So this is really nice when we want to get an accurate depiction of the audiogram particularly for those degrees of loss where we may be on the fence of whether or not this child would be able candidate for amplification. Next, I'd like to move us into a discussion about children with minimal and mild hearing loss. How confident do you feel when discussing with parents at trial period with amplification for children with minimal and mild hearing losses? It can be tough, can't it? So for some clinical audiologist, they feel that they may not be equipped with enough information to have this discussion. So let's start with some good news and that is the research on children with mild hearing loss. Over the past five years, minimal and mild hearing loss has been receiving a lot of attention. And this is in large part to the fantastic work being done by Elizabeth Walker, Ryan McCreery and Meredith Spratford. Their data collected

in 2015 shows that when children with mild hearing loss use their hearing aids, they achieve better outcomes with vocabulary and grammar than those users who do not. So does this convince families to use hearing technology? Well, for some it might and for some others, they still may be on the fence. I know myself, it was not uncommon for a parent to say to me, "You know, we noticed that they hear really well "at home, and my family doctor thinks it's best to wait "to see how they progress in school." So we still are faced with some challenges, even based with this data from Walker and colleagues. So that leads us to our next tip, which is using some clinical tools that really can help strengthen some of our counseling discussions with families. The first tool is called the SHARP which is short for Situational Hearing Aid Response Profile, and this was developed by the Boystown National Research Hospital. It was designed to characterize the audibility of speech sounds across a wide range of realistic listening situations with varying acoustics. Essentially what it does, is it uses the speech intelligibility index to show changes in available speech that is audible as distance between the speaker and listener occur.

And it also allows you to compare unaided and aided results across these different listening situations. The best part, this tool is free and can be downloaded by visiting the SHARP website. The second tool that is at our disposal as one that we just mentioned, which is ensuring that we have an accurate representation of the HL audiogram and this is done again, by applying the RECD at assessment to use our verification system to provide those corrected thresholds. Our final tool is validated questionnaires. This allows ourselves, school-based hearing professionals, families and friends to complete simple questionnaires that are going to provide an overview of different functional listening abilities with and without amplification. So for example, the LIFE Revised is a tool that allows a classroom teacher to evaluate a student's listening abilities. It also has a subsection that allows students self-report where they can report how they feel they are listening in the classroom. There's the Functional Listening Evaluation also known as the FLE. This again, talks about accessing verbal

instructions, looking at the effects of noise and distance and a lot of this, these measurements are done by using words, phrases and nonsense words. The nice thing is that for this version, you can use live voice or prerecorded versions, which of course, are calibrated quite nicely. This is a tip from one of my colleagues at the KIPA Group, Eileen Rall. And when she's working with minimal or mild hearing loss and families that don't seem to be concerned about hearing at home, she focuses in on addressing classroom listening. So in this situation, she offers family a flexible fitting alternative, using language like, "Can we agree that hearing the teacher well in the classroom is important for your child's learning?" So here in this scenario, Dr. Raul is focusing on accessing important listening environments where hearing and learning are really, really important.

This is also an opportunity to have a discussion with families that perhaps we are using it initially in the classroom or in the preschool setting, and we are going to reevaluate that need for amplification on a yearly basis. And again, one of the terms that Eileen used was, this is an opportunity to reduce auditory squinting, or provide a opportunity for easier access to spoken information. The next tip that I wanted to talk about is something I always struggled with, which was making good ear molds for babies. For this tip, I turned to Marlene Bagatto, a member of the DSL Team at Western University and my co-chair on the Pediatric Bone Conduction Working Group. As many of you know, Marlene has years of experience working with infants and young children. And here's some tips that she recommended when working with infants and trying to get good ear molds. First, we need to acknowledge this is a new experience for the family and for the baby. So don't be afraid to say that ear impressions may feel weird, and it's important to show the family all of the different pieces of equipment to certainly help manage any anxiety they might be feeling. Next, we wanna consider using a silicone material that is medium-bodied. In other words, it's going to cure or hardened quite quickly. We also want to make sure that we choose the right size oto-block. So in this scenario, we have an opportunity to premeasure the oto-block and align it with our

oto-light. Why is this important? Well, this is going to then tell us how deep to push the oto-light in. So if we have that auto block premeasured and we make a mark on our oto-light tip, we know how far to push the block in. And I think for many of us, again, this is a point of discomfort, knowing how deep is deep enough when putting that block inside. Another important thing is to ask for help. caregivers can assist with the procedure. Babies often will move when impression material is applied. And we just want to get parent or caregiver to help cradle the head just for that portion. We also may want to use your hand as protection, while curing this is to make sure that should the infant's shoulder come up around their ear. It's not going to affect your ear mold impression that's being taken. And I would say this is probably the number one reason that my ear molds are not coming out well is I had babies whose shoulders would push up on their ear canals, and that would definitely affect the quality of that impression. We certainly want to make baby comfortable, have them in a cuddle position against the caregiver, not cupping that year is going to prevent that ear impression from getting squashed and changing its shape.

So we know for small ears and small ear molds silicone material is best, as we get a nice secure fit, and that secure fit with the silicone is going to be really nice for reducing feedback. Number 13, hard wall tubes are also really nice, but for small ears, we may have to use something called a step down tube. This is a tubing that narrows near the end of the ear mold, which allows it to go through the canal portion of the ear mold so that it can be extended all the way to the end, thus making it more secure. So if you're not familiar with that step down ear mold. It's the first image you see on the screen with the number 13 to 16 tube lock so you can see the ear mold is a normal size as it starts and then the part that is going to go through the canal portion of the ear mold narrows to allow it to fit and go to the end of the ear mold for that more secure fit. So for our next discussion, we're going to move on to remote microphone systems. So remote microphone systems previously known as FM are essential and essential part of classroom listening for children with hearing loss. What we're seeing now is, is that

in many states and provinces funding is available and is in place to support the use of remote microphones at home, beyond schools. So have you ever thought about using remote mics with families at home? And what age should you be using this at? Well, certainly there's, have been some really nice research coming from Vanderbilt University in the last year or two. And their recommendations are, is that remote microphones should be considered for home use when that child becomes ambulatory. In other words, they're finding their feet, they're able to move away from parents or caregivers. And thus we see a distance between the speaker and the listener increase. What they found in this study in 2017 is that by using remote microphones at home with these kids who are running around the house, this provided those children with up to 42% more access of words per day. The other thing that's really nice is we know remote microphones help improve auditory access in those daily listening environments that might be difficult to hear in, for example riding in the backseat of the car. The other thing that's really cool is new cost conscious, remote microphone systems like the EduMic. Also make remote microphone technology very affordable, even where funding options do not exist.

Now when thinking about evaluating your remote microphone system, one of the tips I can share with you is to be for those children who are verbal and you are asking for some confirmation of sound quality once they are connected to their remote microphone system, ensure that you are at least six feet away when doing this functional listening assessment. This is because if you're standing too close, let's say one to two feet away, your voice may be picked up by the microphone of the transmitter as well as the hearing aid microphone and this is going to combine the loudness. The child may report them that the voice sound's too loud. And this certainly isn't an accurate representation of how they would be hearing at a distance So my tip for remote microphones is whenever doing functional assessments ensure you have at least six feet distance between you and the listener. So this next comment is really not exactly a tip or a trick, but perhaps simply a point of clarification that I think is worth

mentioning. So many of us are familiar with DSL, and that there are two versions a DSL Child and a DSL Adult. So which should we be using and when? Well, DSL Child was developed for children with congenital or early onset hearing loss. Whereas DSL Adult was developed for adults with acquired hearing loss, and there's a study that's documented in trends of amplification that talks about the need for the development of DSL Adult that was related to preferred listening levels. So within this study, they had 72 listeners, 24 were children 24 were adults, and 24 were adults with who were new hearing aid users. So we have these nice group of participants, all who are using hearing aids but had different levels of experience. So all of them were fit with the original DSL, which is now called DSL Child, and that participants had a variety of different nonlinear hearing instruments. Each of the new users was provided a 15 to 20 day period of acclimatization. So during the study, the volume wheel was initially set to minimum on their hearing technology, speech was then presented through a loudspeaker in a sound field at 60 dB SPL. And then each of the participants were asked to set the volume control on their hearing hearing aid until the talker sounded like it was very comfortable to them. And this was repeated a few times. So here's a graph that reflects those preferred listening levels.

So just to provide you an orientation to what we're looking at, on the x-axis is recommended listening levels and on the y-axis is preferred listening levels. So essentially, we're looking at preferred listening levels and comparing those to recommended listening levels as recommended by DSL. So for the three groups of subjects the children are represented by the squares, the new adult hearing instrument users are recommended by the open triangles and the experienced adult hearing instrument users are recommended by the filled circles. So what we can see here is that new adult users had preferred listening levels that were softer than children and preferred a different setting than the default of the original DSL method. So this is really what informed the development of DSL Adult was that experienced adult users and even some adult users, pardon me, new adult users and even some experienced adult

users, had much different preferences. They like their listening levels to be softer than those children with congenital or early on onset hearing loss. So what does this mean for us as clinicians? Well, it means that for those children who are using hearing aids and have been fit with DSL Child, they may continue using DSL Child through adulthood. Of course, if we are using a different prescriptive method as part of a different hearing aid fitting, one that might be proprietary to a manufacturer, of course, this also could be used. But there is no need to change a child to DSL Adult simply because they are now an adult. As this chart shows, the DSL Adult is really designed as a prescriptive fitting method for those adult users who are new to wearing hearing technology. Now, further on that note, question that also comes up quite frequently is, if I am not able to meet all of my DSL targets for a number of different reasons, which is perhaps limited clinic time or limited audiometric data, which targets are most important, and you can see here that both Dr. Richard Seewald and Dr. Marlene Bagatto agree that the two most targets that we want to try and get first are matching targets for moderate speech, and then making sure that DSL targets for MPO are also met.

So we want to ensure that spoken language at an average conversation level is accessible. And also that loud sounds do not become uncomfortably loud. So our next tip is really focusing on looking at how can we meet targets, what things are going to affect our ability to meet targets? And are there any strategies to try and optimize that target match? So first, when we think of different factors that can affect our ability to meet targets? We can think of type of hearing loss, shape of hearing loss. So in other words, if we have a severe hearing loss within the amplification ability of the hearing aid, we may not be able to say meet that target at 4000 hertz. This is also a good case or a good example when we have very sharp or sharply sloping precipitated losses between frequencies or when we see notches. The other thing we need to consider is that some pathologies may also alter the performance of the auditory structure. So, if we have a significant conductive component or we have a stiffening of the middle ear

system, that also may affect our ability to deliver amplification to that ear. So, I talked about our ability to optimize targets. The first thing we need to think of is, are we comparing apples to apples? In other words, have we done our best to enter in all of the data correctly making sure that we are doing our best to account for any user error. So here what I'm talking about is making sure that the information we say, enter into the Oticon Genie software is as accurate as possible. So this reflects ensuring that we have entered the correct age. Particularly if we are going to be using predicted RECD's. Have we selected the same transducer that we used in the sound booth? Have we selected the correct prescriptive strategy? Have we entered the ear mold acoustics? So if we've provided a large or medium vent, have we acknowledged that in the fitting software and then have we entered the RECDs, whether they are, if they are measured, then we've entered those or if they've predicted we've checked that box. Doing all of these things is going to certainly give us the best opportunity to provide the necessary corrections and give us the best opportunity to meet those targets. The next thing is when meeting targets is, making sure the hearing aid is properly placed in the test box. Did you know that the Verifit1 has an appendix where it recommends how a hearing aid should be placed in a test box?

Well, it does. And this is because placement in the test box with a Verifit1 can actually affect our measurements. So here's a nice example of a measurement using the Verifit, where we have a correct placement and then we have one that was just placed with the hearing aid in a vertical position. So what we see is variations in the placement can lead to a misrepresentation of the hearing aids performance and as received by the green line. We are now not meeting our target at 4000 and 6000 hertz, okay. The other question that comes up quite frequently is, why do we see a lot of peaks with our with some hearing aids and when we're running our MPO curves? Well, with every new generation of hearing aids, we're seeing less and less of this but when we see these peaks, what do they mean? Well, often it's related to the coupler that we're using. In other words, the HA2 coupler in the Verifit, that there is a resonance peak that occurs

when we attach a hearing aid to this system. So, for example, if we were to do a real ear measure, we wouldn't see that same peak because no coupler is being used. So, typically peaks with MPO occur when we are adding a BTE coupler and tubing to our ear mold in this calculation, the MPO peak will disappear when we remove the BT coupler effect and again, this can be done when we are doing real ear measures or by using our HA1 coupler which has no tubing. And why is it that we don't see this in all models of hearing aids or in all different hearing aid manufacturers. Well, what's interesting is that manufacturers have a number of different options when building hearing aids. And one of these things that they can do is add filters. So filters are something that can be managed internally or externally like we see in the earhook. So internal filters, or the external filters, both function to do the same thing, which is to smooth out peaks at different frequencies.

So next I'd like to move into our final discussion which is looking at open fit hearing aids and children. So open fit hearing aids are an amazing piece of technology that has many attributes that appeal to adults with hearing loss. It's no surprise that for those tweens and teens, who are starting to become self-conscious about hearing technology, this type of hearing aid is also very attractive. So this is what we're going to explore in our last part of the presentation is what are some considerations and what are some good tips to achieve good fittings? For this, we're going to be looking at some research studies that talk about some of the benefits to this technology. We're going to review some general candidacy, we'll look at some fitting considerations. And then finally, we'll look at some benefits and limitations. So first, just to make sure we're all on the same page, when we talk about an open fit hearing aid, we're talking about a style of hearing aid that is characterized by its molding or coupling and its minimal occlusion of the ear canal. Okay, so typically, this technology might be referred to as a thin tube device, as a RIC, which stands for Receiver in the Canal, a RITE, Receiver in the Ear. And typically when we're talking about an open fit it is typically coupled with an open dome. Now, we can also use a custom ear mold for those individuals with

more severe losses or that require low frequency amplification. But we then have to acknowledge that the category of this hearing aid being described as an open fit may in fact change. So one of the things I've always been interested in is teenagers, tweens, which is those 10 to 12 year olds and really what drives them to accept, or accept their hearing technology or adhere to our care as audiologists. So I'm gonna share with you a couple of studies that I ran the first is, looking at perspectives of hearing care professionals when working with teens and tweens. So in 2017, I was really interested to know how clinical audiologists might be using open fit hearing aids with their pediatric patients and did this web-based survey. So this was sent out to about 500 clinicians working in Canada and the United States. And from those that were invited, 113 participated and they identified themselves as being clinical audiologists who have tweens or teens with hearing loss on their caseload. The objective was to understand the challenges clinicians might face with hearing device use when working with teens or tweens.

So one of the first things I wanted to know is for the clinical audiologists at what age do they consider selecting an adult hearing device, like a thin tube or a RITE hearing technology? What we see is, is that between the ages of 10 and 14 is when clinicians consider using open fit devices. This likely reflects ages when tweens and teens begin to reject their typical BTE devices. It also might be that they have an ear canal to support a receiver in the ear. And finally, they also may possess the competency to provide a correct insertion of that receiver in the ear device. Next, we wanted to understand from the perspective of the clinical audiologist is that when teens are complaining about their hearing device, what are the main things that bother them? Well, we are all very much aware of the importance of cosmetics to teens and tweens. And this certainly was reflected in this survey where we see size of the hearing device was rated as being the most important. a close second was the performance of the hearing device so that teenagers complained about not being able to hear their friends in noisy environments. feeling like they were excluded from conversations while

walking in the hallway, moving from class to class and describing situations where they're hearing technology simply did not last like playing sports, where a lot of moisture was being created. And they're hearing technology would simply die. So some of the comments that the clinician shared with us was that teenagers complained about sound quality for music. They complained how hearing aids made them look different. They wanted a hearing device that had a seamless connection to all electronic devices without the need for an interface, like a streamer. They wanted a hearing aid that had good reliability when they were active in sports. And they wanted something that worked very, very well in noisy environments. So what's cool is, is that since this survey was delivered, a lot of these things have been realized. Where you know, we no longer need a streamer. And we have apps you know, the Oticon ON App made for iPhone and Android devices. And so a lot of these things have been realized. Next, I'd like to just turn our attention to some of the research, most of which has been done by Patti Johnstone that talks about some of the acoustic benefits to using open fit technology. So what she noted was that with closed mold fittings, adult ears act like an amplifier for low frequency sounds, and this is where many adult patients will describe their voice like listening with their head in a barrel.

Even with the use of venting, this may not adequately address the occlusion difficulties. So one of the things I always wondered is, Could these effects be translated to children? Or you know, I guess another way of stating this is, do children experience the occlusion effect? Well, I guess one of the things we would probably have to start doing is asking them about that. And I could say that that was something that never crossed my mind was to have articulate older children who could communicate through spoken language, tell us or tell me about their experiences of hearing their own voice. So this is really something that could be considered a part of our assessment to make these inquiries about their perceptions of their own voice and as we make different adjustments, if they have a setting where their voices maybe have a preferred sound quality to them. We know this is important because Johnstone found

in 2016 that when 17 out of 18 children used an open fit hearing device, they've noticed an improvement in their own voice compared to when they were using their BTE with a typical ear mold. So that certainly is good information to take note of. We also know that open fit technology plays a role in sound localization and high frequencies. So we know the open fit device is optimized for high frequency amplification but not so apparent is the fact that it does play a significant role in improving, sound localization abilities. And this was highlighted quite nicely in an older study by Noble in 1998, who noticed that when comparing a BTE with a mold and an open fit with a dome, those using a dome and an open fit had fewer errors in sound localization abilities. Now, this was set up in a lab environment and so they had very sophisticated and multiple speaker arrays to make nice sound localization measurements. The other thing that, also from an older study Makous and Middlebrooks found was that the open fits also seem to do a better job of preserving high frequencies that contribute to maintaining interaural timing differences that are also associated with good sound localization. So of course, we do have a challenge when we are as clinical audiologist trying to consider assessing sound localization.

First, our typical hearing aid fittings, using DSL or some of our outcome measures, we don't really have feasible tools that are available to help us better understand sound localization improvements that might be gained by using open fit technology. Now, even though Johnstone and colleagues found that children can see similar results like those adults from Nobel study, in other words they had, they also had fewer localization errors and when using their BTE enclosed mold. We are still faced with the difficulty of measuring this. So Johnstone study again was done in a lab setup with a multiple speaker array that isn't typically found in our sound booths at our clinics and hospitals. So I guess our wish is, is that, could be that soon, we might have clinically feasible equipment where we might be able to do some of these measurements in our local audiology clinics. So are there limitations to open fittings? Well, we've been talking a lot about the benefits for high frequency hearing losses. And I guess that

takes us to our very first point which is when we are using that open dome. We are not providing little or any low frequency gain. So we are then going to have to shift to more of a closed mold with that thin tube, which again, is changing that category from open fit to closed. Another limitation is that when increasing gain, we may run into feedback, especially when we consider more severe high frequency hearing losses. We talked a little bit earlier about those 10 to 14 year olds in the survey, where clinical audiologists are typically fitting because of the likelihood of the need for that large ear canal. That is a limitation of this technology that receiver size does dictate. Who can use this because they do need to have a sufficient ear canal size to support that earpiece. So now let's review some of the candidacy for open fit technology. So who of our pediatric patients, those that are teens and tweens, might be good candidates. So the first thing we want to consider is degree of loss. If we are going to truly use a open fit technology with a dome, does their hearing loss fall within that fitting range? In other words, do they require amplification only above 1000 hertz.

Also, can that open fit device be used in a child-size ear without feedback? Certainly very important to consider. Next is age of the child and this really goes to or comes down to, can that child manage correct insertion of that open fit mold into their ear. So in other words, if they find themselves at school, and they need to change the battery, or if their device stops working, and they need to remove the hearing aid from their ear, are they able to after troubleshooting, provide correct placement back into their ear canal so they are getting good amplification? Certainly when we think of very young children, we may be thinking of personal safety and thinking of these smaller hearing aids as possible as a choking hazard. But I would say that we typically aren't thinking of this technology for infants and very small children. Next, we have to think about the lifestyle of the child. So is there first appropriate retention of the open fit? In other words, does the dome and the tube length keep the device in place while participating in vigorous children-type activities. The other thing we want to consider is if this child is producing a lot of moisture or sweat is using a receiver in the ear going to make this

problematic. So because of the proximity of that receiver being in the canal, is it going to be more exposed to moisture? And are we looking at a scenario where we're going to have interrupted device use because the device stops working. This isn't such a big issue anymore because now remote microphone technology is available for most open fit devices. So for example, the Oticon EduMic remote microphone can be used with all of our current open fit hearing devices. But certainly if we are considering another manufacturer's open fit technology. Remote microphones still are very essential for accessibility in classrooms and we want to ensure that some type of remote mic is available. Next, we wanna to know is this truly an open fitting. And what's fantastic is our Verifit1, or Verifit two can really help us determine this. So in other words, we don't want to simply assume that by placing an open dome and receiver into an ear canal, that in fact it is open, because we can't actually see with that deep insertion, what is happening to that dome. So we can use our probe microphone measurements and do on your measures and do what we call a real ear unaided measured response. Then, with that probe mic still in place, insert our open fit hearing aid and run a second curve with speech, which is what we call, our real ear occluded response.

We then can simply compare these curves they're going to be hopefully superimposed onto one another. And if they are, and we don't see a difference, it means that the placement of that hearing instrument, receiver and dome into the ear canal has not changed the characteristics or the openness of that ear canal. In fact, on a lot of the verification systems, there is a test titled, Occlusion Effect Tests. Also available on AudiologyOnline are some really nice, real ear measure courses that take you through this step by step and those are provided those courses are provided by Audioscan the maker of the Verifit. So when it comes to a suggested method for fitting open fit hearing aids, we don't have a triple A guideline, for example, or we don't have a document available that is evidence-based. But what I believe we can do is try and adapt some of our measures that we're quite comfortable with that make good sense and use those as a, to create this suggested method when fitting this type of

technology. So first is to measure the child's RECD. Again, this is going to be very important so we can convert our HL audiogram from the sound booth into SPL. And then we also then can enter that RECD into our verification as part of the hearing aid fitting process. We're then going to program the open fit hearing device using an available rationale in the manufacturer. Or we could simply choose DSL on the Verifit. We need to keep in mind that all of the measures we are going to do with our pediatric people are going to be on your measures as we don't have the ability to accurately do coupler-based verification. So, even if we think we might be able to putty, the dome using the HA1 coupler, there's been some good articles published by Susan Sculley that talks about that visually, we might see that there is doesn't appear to be leakage, but we still can't depend on this type of a measurement.

So on-ear measures are certainly the way to go when fitting this type of technology. So after we meet our targets, this is of course giving us our best starting point for the hearing aid fitting and our next equally important step is to complete validation or outcome measures. So really, what we wanna do is use some sort of validated speech test questionnaire to give us information about the real world functional performance of that child or teen in both quiet and complex noisy listening environments with this technology, okay, so in other words, if we are fitting a open fit technology on a child or teen with a high frequency hearing loss, using something like the California Consonant Test, which is a high frequency word list probably is a good idea, because this is where the amplification is, is being targeted. And this is certainly how we want to try and evaluate the system rather than using a word list that is equally balanced across all frequencies of sound. So that's certainly something to consider. The other thing is, is that when we do these tests, particularly those speech and noise tests, it's also going to provide us some evidence that might justify the need for some of our advanced features to be activated, like noise reduction or directionality, also might help us determine the need for remote microphone usage. Okay, so those are the tips and tricks that I had to share with you today. I've provided you with my email address on

the screen. And certainly I'd love to hear from you if you have a favorite clinical tip for hearing aid fittings in children. As I said, I'm here today as a knowledge broker sharing all of these things that you as clinical audiologists have provided with us, provided it to the KIPA Group over the years. And so I thank you for sharing those with us. And hopefully you found some of these tips and tricks very informative. So we now have some time for some questions. So the first question is about where the Johnstone 2016 article came from. And if you email me, I can provide you with that citation. My recollection is that it came from the American Journal of Audiology, AJA but I would have to double check on that. Because my Friday brain is not allowing me to access that reference at this time but thank you very much for that question.

And certainly send me an email and I could actually provide you with the reference 'cause I do have the references for those articles that I shared with you today. I also believe that that article is, is open access so that it is available for everyone. So one of the questions that does I, that I would say was the most popular question in today's presentation was this notion of measuring the RECD at assessment, and there was a lot of people who were very surprised that how important this was, and I would say, this is really, really important in those preschool years to correct that HL audiogram. You know, when I think back to my clinical days, which began in 1993, I recall using TDH headphones and as these kids with hearing loss got older, I would frequently see their hearing thresholds get worse in the high frequencies. And, again, this was just their ear canal growing. And those sound levels, those sound pressure levels equalizing to be closer to the calibrated level in the audiometer. So, I would say that, you know, measuring that RECD at assessment, especially in those preschool years, when the ear molds, when the ear canal side is changing, is really important for correcting your audiogram. So we have another question here about any tips for teenagers who start thinking they only need one hearing aid because their friends are not using a hearing aid? You know, I think for myself talking to teenagers, what really resonates for them is to talk about how hearing well is really connected to future success. And that we could

even engage with their permission, one of their friends into completing one of these functional listening questionnaires. So there is a version of the LIFE Revised. And those are available from Karen Anderson's website, Supporting Children with Hearing Loss. Those are available for free. But there's a peer version where the friend of the student with hearing loss can rate their hearing abilities. So what I would suggest you might do is to have that teenager wear both hearing devices and have their friend rate their hearing abilities in a typical environment and then have them rate when they're wearing just one hearing aid. And sometimes hearing from a friend that you know, "You don't hear so great. You might think you are, but you're really missing a lot." And again, this is done with a teenager's permission.

But that can be really powerful. So again, just to sum up, it really having a discussion with them that you know, doing well in the future, having a successful career, whatever their interests are, is really connected to hearing well, and secondly is to try and get a friend involved that might help rate their hearing abilities. So when we were talking about assessing the RECD and correcting the HL audiogram, the question came is do you plug these HL values into the Verifit? And the answer is yes, you do. So you plug those HL values into the Verifit there is a on the table screen, there is a part for you to, there is a place for you to enter the hearing thresholds along with the RECD measures, and that's then going to provide you with a corrected DBHL value. Okay, so just to restate that one more time is that, you're going to take your audiogram thresholds along with your measured RECD and plug those both into the Verifit. There's a table for that. And then that's going to provide you with corrected DBHL values that you can then replot onto your audiogram. So another question is around doing some sort of aided speech testing as part of validation, live voice for younger children. And I'm hoping I can see the rest of your question here 'cause some of it is cut off. Let's just expand that, oh, there we go. Do you have any advice regarding wearing masks and doing the tests these days? What I can, it's a great question. Thank you for that. What I can tell you now is that on the Educational Audiology listserv there's been a lot of

people talking about different degrees of audibility when using remote microphones and masks and how while some of the audibility seems to be preserved with some masks, other we see that it is slightly compromised. Now at Oticon what we're doing is something a little bit more methodical is we're going to use our KEMAR manikin in the lab and we're going to set KEMAR up with a microphone and different masks and we're going to look at frequency response output and doing some measures of sound quality with the KEMAR manikin using different masks and so what I'm hoping to do is we're hoping to have these tests start next week. And then what I would like to do is share these results on the EAA listserv, as well as they will be shared on the Oticon U.S. website. So it's a really, really great question. What we're seeing now is that informally what people are doing in the tests is there seems to be just a slight test, whereas those that are wearing the plastic shields, there definitely is a greater impact. So the degree of the degree of impact is something that we will be measuring and we will be providing to you in the next week or so.

So, we have time for I believe one more question, which is a long what is the best way to bring families out of denial? That their child could benefit from hearing aids is doing well in the future, the best way to do this? Just going to expand that question, best route to take as well. You know, I really think it is is that one of the, some of the experiences I had with families where the use of hearing technology was an issue is that I talked about optimizing brain development, and I talked about optimizing learning opportunities to ensure the best possible future for their child. And, again, like Dr. Raul suggested, I also offered a flexible fitting but the way that I framed it was is that I looked at hearing aid use as something that we would discuss at the start of each school year, and that we could discuss the need for the hearing technology year to year. And so I think by not assigning a level of permanence to that fitting, that also seemed to have families come around when it was framed in addition to wanting their child to do the best, have the best possible future they could and have the best access to auditory information in the classroom. So that's what I would recommend is taking

conversations to that have that tone, where, you know, you say something like, "Can we agree "that we want your child to be "as successful as possible in school "and giving them the best opportunity for a future? "Can we agree on that? "Because I believe using a hearing aid "at least in the classroom can really help with that." And we have some measures that can really help see whether or not this is occurring. And then that's where I would turn to my colleagues who are the school-based hearing professionals to perform some of these functional listening evaluations. Well, that concludes today's presentation. Thank you so much for attending today. I really appreciate it. And again, if you do have any tips or tricks that you'd love to share, again, these all came from you today and I was pleased to share those as part of the KIPA Group. But definitely send me an email and I wish you a great Friday and a great start to the weekend.

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