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Coupling Matters: Understanding the Acoustic Effects of Domes, Earmolds and Encased Receivers

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All right, thank you for joining. Hello, everyone. I'm Jill Mecklenburger. Erica Koehler. And we're here from Resound to talk to you about the acoustic effects of domes and ear molds and a little bit about encased receivers.

So we're excited to be here with you today, and we'd like to get started. We want to make sure you understand venting concepts to be able to balance openness, transparency, feedback, and sound quality control.

We'd like you to be able to learn how to use coupling solutions to troubleshoot the most common types of hearing aid complaints and just to you can review those limitations and risks from ao. And with that, we'd like to get started here. All right, thanks. So, as Jill mentioned, we're going to be talking about coupling, understanding the effects of the domes and the ear mold, and a little bit about encased receivers, because this is a pretty important topic, because when you're fitting hearing aids, how you couple the hearing aid to the ears actually has quite a bit of impact on how the wearer hears the sound.

So we'll get into all those details here.

Right.

All right, there we go. Okay, so we're going to start with just a review of ear coupling, the effects of the coupling. We're going to talk about the selection during a hearing aid fitting, and then also ear coupling selection for troubleshooting. So starting here with the review, before I begin, I just want to point out that if you see during the presentation a small question mark in a circle on the slide, that is a little bit of a hint that you might want to remember the info for later. Wink, wink.

So just keep an eye out for the. The black circle with the question mark in it. Okay, so getting started with the review section, I just want to use a really practical example here about ear coupling. So I'm showing three different vessels here. They are all, let's say, the same size, like about.

About a medium takeaway, cont. So 355ml. But as you can see, they are the same, but different. So I'm going to ask Jill, since she's here with me, if she can just point out some obvious differences with these containers and their lids. Yeah, what I'm noticing is the one on the left, which is our measuring cup, that's completely open.

It has no lid, and it has a really wide opening. Whereas the cup in the middle, that's kind of my favorite Starbucks order that I get with a medium latte that has a covered lid, but a pretty small hole or opening to that vessel. And then finally the one on the right, which is kind of more of like those fancier drinks that people get sometimes at Starbucks, like a Frappuccino or something. The lid is different, actually. It's domed going outward, so it kind of creates more volume within the cup.

And then it has sort of a medium sized hole, you know, in between the other two. Yep. And I'm glad that you pointed all of those properties out, because that actually affects with what I'm going to do here is when I dump the cups over. What do you see notice about this? Yeah, it's really interesting, especially comparing it to an ear canal, the measuring cup, which, with the largest opening, spills out all of its contents, really.

So everything inside leaked out. The middle one, the kind of a small amount because it had a small opening to the lid. And then the. The last one on the right kind of had somewhere in between like a medium amount of volume which leaked out of that cup. Right, perfect.

And I just want to make the comparison here between the ear canal and the vessel. So we have like an average ear canal, and that was the cup. It is closed on one end, just like an ear canal is. And. And

then we have different lids.

And like you described, some of them were better at keeping the contents in once we dumped them over. And some of them even changed the size of the vessel by making the dome, making the vessel larger. So this is just a good practical example of how changing the lid or the earpiece can change the property of the canal and its ability to contain what's put in there, which in the case of the hearing aid, is the sound pressure. We're going to take this analogy with us through our fitting, but we'll just remember that we have average ear canals. And while they're the same, we are modifying them once we're changing the lid and.

Or earpiece. All right, so let's talk about the specific effects of the earpieces. I just want to show this slide here, not to overwhelm anyone, but to also show the scope of. Of earpiece choices that we have. So there's quite a few.

They usually fall into two different categories, one of them being custom, as we see on the top here, and then something that we like to call stock domes. And these are the ones that you, of course, don't need to take an impression, but just come from the manufacturer and you can pop on from the drawer. So we did add to our stock dome, so you may notice that there's more options and we'll sort of get into those later. But it makes it a little bit difficult sometime on how to choose. So everybody has different philosophies on how to choose and what they lean on.

So if you are feeling brave and you want to type in some of your favorite domes or your go tos or your philosophies, feel free to share with the audience because knowledge is power here. But yeah, I like to try to get an occluding dome on somebody. So I will try to occlude them as much as I possibly can or as much as they'll let me. But Jill, what, what's your kind of go to here when it comes to domes? Yeah, it's interesting.

Like you said, everybody's got their own go to and why and I'm kind of old school. My favorite dome is the Tulip Dome. It's been around for a while and I just love it. I feel like I've had so many good experiences with it. It works on lots of different ear shapes.

So because it's expandable and versatile, I feel like it can be kind of open or a little more closed if I need it to be. So I'm a big tulip dome fan. Great. And I think that many people like the stock coupling options and I think there's a lot of reason for that. And one of the reasons is that the hearing aid style sort of lends itself to the stock options.

And this has changed over time. So we're seeing a trend, of course, going towards the thin tube and RIE type hearing aids is away from the bte. So again in the chat and Jill, you're going to be in the hot seat if no one writes in. But what do you think that the percentage is of the, the stock dome or I'm sorry, the Rae and stock dome fittings compared to the BTS anymore in the U.S. any, any guesses? I know the, the pie graph here gives a little bit of a hint.

I think it's 70. 30. 70, 30. Good guess. Something tells me you knew the answer.

But yeah, 70, 30. So many, many fittings that lend themselves to, to the stock dome. So we're going to sort of get into what do those stock domes mean.

And this study I think is really nice because it's pretty comprehensive. It used 58 ears and they use a variety of domes. So open two semi open tulip and a double dome. And it was kind of intra and intersubject comparison of how these domes fit in all these different ears. And then there was a lot of data that came out of this and nice compare and contrast of how the data compared within each person and then with each other.

I want to take a look at that a little bit here. What this is showing is distilling that study's information down into what I found to be three principles, one of them being the vent effect. So that was how did basically the lid leak out the contents? They would have put putty in the ear and took a measurement of the completely occluded ear, which you would see on the graph there with the bluish colored line. And then would take a measurement with the dome in the ear and see how those two differed.

So completely occluded versus the dome, how much is leaking out. Thus you get the vent effect. The next principle was the transparency. So that is how transparent was the dome or the earpiece to the ear canal.

So how much of the open property was maintained with the dome? And that was comparing the REUG to the RE og. And then finally there was subjective occlusion measurements that were taken into account by basically asking the wearer how occluded they feel with any given don't. So we'll look at some of the data within those principles. So if we kind of focus our attention here on the A section on the left, this is looking at the transparency.

So you'll notice here with the. The more flat line, this is the open. More open property domes, meaning that it's most like the open ear canal. And as you see it dipping down into the negative, that's where you see the deviation from open. As we move through those squares there from open to double dome, you'll see that those dips become deeper and deeper and deeper where the deviation is coming away from the open ear canal.

And thus the transparency is being reduced as you plug up the ear. Yeah, really interesting to see the variation and how the response changes with all the different domes. Yep. Then if we look at our other principle here, which was the vent effect is how much is the low frequency is rolling off. Again, just keep a reference on the flat line here.

As you see it dipping down away from the flat line, this is how much of the lid was leaking out the contents. You can see the biggest leakage being with the open, the biggest bent effect with open dome. Then of course, as you get towards the double dome moving through the squares, you can see that there still is a loss, but it's not as great as you would see with like a tulip or an open dome. And I think that this is a really important thing to Point out is that a lot of times when we see our double domes, we like to see them as fully occluding. And that's not always the case.

They're not custom, they aren't fully blocking the ear. And we should expect on a really ear measurement that there could be some low frequency loss there. The other thing that I would like to point out on these graphs is the shaded area. That shaded area indicates variability. If you notice on the transparency measurement and also with the vent effect measurements that we have the thickest shaded area around the double dome, meaning that those domes are the most variable.

When you're looking between the ears, open is open for most people. It has that property. It's transparent. How the double dome fits in particular ears is definitely different. And that's an important point to take home is that really watch out for how much loss you are getting between patients with the double dome.

And remember that variability there with the more occlusive domes.

Here we're trying to balance these three principles, and they're all kind of overlapping and related. We talked about the transparency, the occlusion and the vent effect within the study. And our job as fitters is to try to kind of nail it right in the middle and balance all of these properties. So we do have a, the vent effect in the occlusion sort of being inversely, inversely related. So as you increase the vent, typically the occlusion sensation decreases.

We have a relationship between the vent effects, again, the loss of low frequency gain with the transparency of the device, and those are also related.

And then we have, depending on how much gain that we have that we're using, we could have an inverse or related effect here. If we are providing low frequency gain and we do have a more an open fitting, then we could run into a comb filter effect where it can have more of an echoey sound property to the listener. But if we're not looking to provide low frequency gain and we open up the ear, then we do relieve some of that occlusion. So kind of remembering to balance all, all of these and try to hit that sweet spot in the middle. So that kind of brings us to our fitting now, which Jill will talk about.

Yeah, I think it's a good point though, that you mentioned about that comb filter effect, because I think people often don't realize when you're fitting really open, if you're adding low frequencies, sometimes people don't realize the effect that that might have. Yep, exactly. So open doesn't always mean occlusion free, especially if you're trying to pump in the lost gain. Yeah, definitely. But let's talk more.

Let's get more into these fittings based on the three principles that you were just talking about from that study. We have both measurable ways to determine which lid to fit on your cup, but also more subjective ways. So some of the things objectively that you want to think about is how much leakage or low frequency loss coming out of that fitting are you going to be happy with or willing to tolerate for your fitting? What size lid based on the, the patient's ear and the other properties that you want to address. And then finally, another type of objective aspect you want to look at is how much is the user able to tolerate?

Because, you know, you mentioned you like to fit really occluded domes, but sometimes people don't always want to tolerate that. Absolutely. So. So let's kind of look at how that affects fittings. So we talk about low frequency leakage a lot when we refer to the effectiveness of an open fitting.

And really, if you kind of think of it as more the failure to trap the sound pressure level in the ear canal, so the reduction that you're seeing in a real ear measurement. So you want to think about the hearing loss or the amount of gain you need to achieve low frequency targets, because that can really drive the choice of the earpiece. And this is where we can offer some tools within fitting software. So I'm showing some software here, but it's not unique to our particular fitting software. All manufacturers provide tools such as these.

So the first one is a badge that you see over on the left side, indicating the dome recommendation. And we recommend this solely based on the hearing loss that you've entered into noaa. We recommend a particular badge and it's what, you know, we've found from our experience is the best dome for that fitting. However, it's not a hard and fast rule that you have to fit that dome. I think sometimes people think that when they see that badge, they have to use that dome or else, you know, they'll have a bad fitting.

It's really, you know, if you've had experience with that hearing loss with a different dome or that particular patient, it's all very individual. So at the, at the end of the day, really, you're the expert and, you know, this is our recommendation, but you can certainly stray from that. The other information provided on the screen is the vent correction, and you can turn that on in your display options. And when that is on, it shows that, you know, this Particular dome might provide a small amount of venting affecting 250 hertz. So, again, these are really based on averages.

So how do you know if you have an average patient?

Another tool that you can use in the fitting software is actually an in situ tool and it's the DFS or fitting Digital Feedback Suppression Calibration. So we know sometimes it's really easy to just put a power dome and assume that that's going to be completely occlusive, but that's not always the case. So you can use this feedback calibration system to actually see how occluded the canal is. So, so it's looking to

know the frequencies of where feedback is likely to occur, and that's where gain might be escaping from the ear canal. So after you've completed your calibration curve, you can look at the depth of it, and you might be surprised that not all power domes will give a calibration curve hugging the ceiling.

So there might be a slit leak, or you might need a larger size dome or maybe even a custom mold. But just to show you the example here, with the same hearing loss loss, really on both sides, with two different types of domes, you might get two very different calibration curves. And that kind of guides you as well on in terms of how your dome is fitting in the ear. So the deeper the curve means it's more open. That's correct.

Yeah, good point.

So it brings us to what size lid is most appropriate for our particular fitting. And again, as we talked about, there are so many different canal shapes and sizes, so it's really important that you pick the right size when you're choosing a dome. Sometimes people think, oh, if it's a little bit smaller, that's going to be more comfortable for my patient. But as you can see in our illustration on the left here, a small dome, you're going to have a lot of gaps from the dome not meeting the canal wall. So again, a lot of leakage of sound escaping from the ear and you're not getting necessarily the gain that you think you're getting.

And over on the right, if you pick too large of a dome, you might get sort of crumpling of that dome and then it's going to create gaps as well. Another we, we talked. I talked about the Tulip Dome earlier, and I want to go back to that. I've seen a couple people in the comments say that they love the Tulip Dome too, so that's awesome. But when we did some usability studies with audiologists There were a lot of people that talked about the tulip down.

Right. Erica, if you remember. And some people even said they love those slits because they help keep the dome from crumpling, which is another good point. I actually did interviews about the domes, and I

actually heard people were making slits in domes that didn't have it because the crumpling. Right.

When. When I went back and talked to the engineers on the development project for our new domes that sometimes people cut our domes. Yeah, they were freaking out. They weren't happy to hear that. But, yeah, people sometimes modify domes to make them more accessible.

That might lead us to why do we need maybe more dome sizes if people are having to modify our current domes? Yeah, that's a great question. And that brings us to our next slide. Actually looking at our new dome portfolio that we launched a few months ago, if you look back at our legacy domes that we offered, you can see the different dome models as well as the sizes that were available. And comparing that to the new outfit domes that were launched, we have new form factors as well as many more sizes.

So there's a lot more options now. So when it comes to adding more options, is it just the more the merrier here, or how do you come up with knowing that we need this many more sizes or this many more options? That's a great question, because if you talk to the product managers, they don't want to add a lot more because that creates a lot more SKUs. But there was definitely method to our madness when we determined that more sizes and more options were needed with domes. So what we did was we went out and surveyed some of the larger markets that used our company's products.

As you can see here, the U.S. australia, Canada, the VA and Costco were among some of those markets that we surveyed. And here's some of the questions we asked them just to get an idea of what people, how people were using our domes, what they thought were missing. And you can see the different questions that we asked, including, you know, do you think maybe they collapsed too easily? We'd gotten some reports of that. Some people thought that our previous domes were flimsy, especially that open dome, because it has so many holes in it.

We wanted to know if people thought having too many domes would make too, too much inventory for them, and were there any domes missing, maybe that other manufacturers had that they'd like to see us have?

So the survey results, these are some of the top answers. I feel like I'm on Family Feud. We need a larger dome option. There should be an intermediate size between small and medium. It would be great to have a universal non custom ear mold.

More sizes for the tulip. So there are a lot of other tulip dome fans out there, not just me and the people in the chat. Need better wax protection. The wax sometimes gets stuck in the domes. And then finally that comment I mentioned already.

People thought that our domes needed to be more durable because sometimes elderly patients or those with dexterity issues were tearing their domes when they were inserting or removing them from their ears. So there's a lot of feedback about the sizes here. But I know even when I'm buying clothes, if I'm looking for a size medium, just because I have a size medium and one doesn't mean that it's going to work out. So how do you come up with the actual sizes knowing that they're going to be appropriate? Yeah, that's a great question.

And a lot of research went into this. So we started first with something called Sesame, which is this database that GN had from Jabra, our sister company. As you know, Jabra made a lot of earbuds for a while and they had this huge database with 16,000 ear samples in it and looking at all different, looking at the different dimensions of the ears and different ear geometry and they use this, they fine tuned it over the years to get like much better fits with their earbuds. So we were able to access that same database, but of course we didn't need the whole concha portion. We were just really looking at kind of the ear canal and the ear canal opening and so forth.

So we were looking at all of those dimensions and then the distribution as it related to our legacy domes.

And so as you can see here, this was the distribution from the domes that we previously had. And looking at that bell curve, you can see there are quite some large gaps between the small and the medium and the medium and the large. So as well as the tail ends of the, of the distribution not being met, particularly outside of the large end. And that kind of, it's interesting because it kind of correlated with some of the reports we were getting from the market such as we need a size between small and medium and we need a size bigger than large. So it's interesting when that type of data lines up with one another.

So we were determining, we took that data and we were determining if adding some new sizes where that would fit in, adding some extra sizes and also reconfiguring the current sizes to kind of COVID more of that bell curve. So we did we. We did many iterations of this, looking at different sizes, testing them, looking at how well we could capture meeting all of those gaps on the curve. So, so if you just add sizes, then we're good, right? Not necessarily.

But what we finally did to get the final size distribution, in part, you're. Your question is that's true. We added extra sizes such as an extra small and a small. And as I mentioned, we kind of moved the distribution around of, of the other sizes, but we also at the same time changed the thickness of the dome material to meet, you know, many of those requests of the, the flimsy domes. But this also allowed for more coverage to the distribution because you can see the overlap here now of the dome.

So it was, was important to cover this overlap, but also to make the domes more robust. And the overlaps gave more complete coverage to the entire bell curve, but more importantly, giving audiologists more options for fitting too, because sometimes you, you have someone that might be a small or a medium and it kind of overlaps, for example.

So here are our final, final size distribution and how the final product ended up with being able to offer more. We changed the, the open dome a little bit, as well as adding the sleeve dome and some other sizes in the other domes. So. Wow. So I wonder if that study that I highlighted earlier that was showing the variability would maybe be reduced if at the time of the study, if they had such a comprehensive dome lineup.

So if they were able to select the most appropriate size, maybe choose a different option that wasn't available during the time of the study, some of that variability could have been reduced. So it's, it seems important to have a lot of options here because there is so much variability amongst the ear canals. Yeah, that's a good point. I wonder how that study would look if they repeated it with having more, more dome options. So.

Really interesting. Yeah. So we've learned so much about the background of this and the manufacturing aspects. Let's get more back to the, the clinical fitting and how it can apply to your patients. So as we talked about earlier, the leakage is determined by venting, but also determined affected by size.

And I'm going to play a little video here that we created from a fitting looking at real ear measurements, as you can see the rear. And we're looking at different dome types and how, how they show up on a real ear fitting. You may have experimented with this a little bit yourself, but it's interesting and you could always repeat this in your clinic too, if you wanted to see These differences. The first is the open dome. We looked at the leakage for three different earpieces.

So the first one you're seeing here is the open dome. And there's a decent amount of gain as you saw in the fitting software, but it's not really being realized in the real ear measurement because some of that is leaking out. So now it's being run again with a closed dome and you're going to see more gain

from the closed dome losing a little bit at the ear canal, resonance a little bit of that peak. And again with a closed dome, you know, sometimes it functions more like an open dome in the ear. It really depends on the ear, but sometimes it has more occlusive properties, but it definitely provides more gain here than the open dome.

And finally the last one we're going to look at is the power dome. And it's interesting to kind of compare that to the open dome and run another curve to see is it really giving a lot more? Again it can be really variable depending on somebody's ear, but in this case you can see it's giving some more low and even mid frequency gain, but not too much extra beyond that. So that's a significant gain difference there just by changing the earpiece. Yeah, right.

So I think kind of, you know, the lesson learned here is that you may be losing a lot of those low frequencies with an open dome and you're going to see that realized especially in your measurements if you're using closed or even a power or double dome.

So another thing to think about with the fitting is that will the hearing aid user be able to use this and will they be happy with using it? And as we saw in that study that Erica talked about earlier with reinsertion and they were having people, they were running those measurements with people reinserting and we found that, or that study found that experience really matters. The HCPs that were tested in that study, they were the most reliable obviously because they had the most experience. But over time the end users became much more reliable with that with their insertions. So kind of the take home message there really is that you're going to see much better repeatability and that with, with experience.

So can they insert it correctly on their own is an important factor. And also, you know, practice makes perfect. So just as important as inserting the hearing instrument is, are they able to clean it well on their own? Because that's really another important piece of this as well. Right.

You have to make sure that the sound is coming up. If they're not cleaning it, then it's kind of what's the point. So another improvement, or not, that we worked on with these new domes was changing the wax protection. Although the previous wax protection on our legacy domes was good at times, sometimes it created issues. And the photos you see on the left are from a clinical study that we did where one patient had some issues with wax clogging their dome.

So you can see that's kind of an extreme case. But we wanted to come up with some type of better prevention so that the wax didn't even get into that screen on the dome. So we added the wax lube that other manufacturers have been using as well. It's a great idea and concept. And we did a controlled lab test with real patients wearing these devices in their daily lives.

And over a six to eight week period, we saw no wax ingress with this new loop, which was really an improvement as mentioned, because sometimes we'd see wax building up from the previous design, even in just six to eight weeks. Because I've definitely been involved in trials where people have come back within that time period and already telling me the hearing aid doesn't work and it's actually the wax. Right. It's important to have a dome that addresses those issues.

So we've talked about some of the more measurable aspects, but let's talk about some of the subjective points of the earpieces. Because even though we might always have the best intentions as clinicians, patients don't always agree with our, with our selections or recommendations. So you want to think about, you want to consider how much occlusion is your patient willing to tolerate? And then also how does it look in their ear? Because people can often be concerned about that.

So really, how does the wearer perceive the dome both visually and then how it's affecting the sound quality for them? So looking at how much occlusion they're willing to tolerate, we have to go back to our textbook days back in school and think about how is occlusion created. And we talked about transparency earpieces before. So with the lower transparency earpieces, you're getting low frequency

sound pressure at the eardrum caused by the vibrations from vocalizing. And if it's a more high frequency transparency earpiece, you cannot get that direct and indirect low frequency that we were talking about earlier, those comb filter effects in the ear canal.

So either way you're going to sound quality will be affected. And it's a form of occlusion. Occlusion is actually, it's caused when someone's speaking or chewing, you're getting vibrations in your vocal tract vibrating through the bones in the skull. And the walls of the ear canal are vibrating, generating a sound. In an open ear, this doesn't cause a problem at all when you and I are talking right now because the sound is escaping out of the ear canal.

But anytime you put something in there, whether it's a hearing aid or an ear mold, it's going to create a problem because that generated sound gets trapped within the residual ear canal and then the intensity of their voice increases, especially in the low frequencies. And this can be really bothersome for a lot of people.

Again, looking at how much occlusion somebody's willing to tolerate, the difference between the low frequency or low transparency and high transparency earpieces, you could always try to move in the opposite direction. So maybe with a more occluding mold, obviously you might want to make more open or more open. You might want to want to make them more occluding, but it's easier said than done because then it affects the gain too. You don't want to lose too much gain. So one solution to that is the hollow ear mold, which I'm a big fan of those as well.

If I'm going to fit someone with an ear mold, they require less venting than salad to achieve the same effects. And there was a great study done on this back in 2009 when Hollow Ear molds were kind of first around by Francis Cook. Did this study, which I just love. It's looking at the effectiveness of hollow molds and how much people are willing to tolerate them. So the higher rating on that scale, that subjective rating, the more acceptable someone's own voice quality.

So you can see the hollow even with a. With no event, the holo dome is way more acceptable or hollow mold. And the solid only becomes more acceptable as the vent gets way larger where hollow all along is very pleasing to people. So overall the. The users really like hollow much better.

So and the reason is they blend the qualities of the high and low transparency that we were just talking about by providing less of an occlusion effect and less plugging of the ear canal. So I'm curious if anybody out there likes hollow molds or is a fan of them. I think they're great. Seems like a good, a good option when you're in that position where you need more gain, but you don't really want to plug up the ear because maybe they have better low frequency hearing. So yeah, something another solution or an option to try another thing to think about is how does an earpiece look in the ear?

Because we've all had end users who aren't happy sometimes with the way something looks, even if that might be the best thing for them. And I have a great example of how earpieces can offer cosmetic solutions. This particular patient that I saw many years ago had a progressive hearing loss in which the typical choice would be a BTE with a full ear mold. And he had never thought that he could wear a smaller hearing aid because he'd been wearing btes for a while. And then when the ultra power receiver came out many years ago, we tried it on him with an rae.

So a much smaller hearing aid. And with this, you can send the sound directly to the ear canal, obviously without tubing, so you're reducing the chance of feedback. And it's a much more cosmetically appealing solution. And this patient was just thrilled with this because obviously it was more cosmetically appealing and a much smaller hearing aid, which was more comfortable behind his ear as well. So another option to consider with those severe.

Severe to profound fittings. So you were actually able, by selecting a different earpiece with the receiver, you were actually able to offer a completely different experience to the patient, which is. I

mean, Exactly. Life changing. Yeah, yeah, it was really life changing for him.

I remember. Didn't you have a case recently where you weren't able to use the obvious choice for an earpiece for a patient? Yes, I was actually doing a trial here, and we were fitting someone with this hearing loss, and he had been here before with an ear mold, used an ear mold typically, and the ear mold didn't make it in time. So I think this is an experience that most people have had not only here. Right.

And I kind of was a little concerned about what I was going to do. So I was trying to think outside the box. And this was available, like, newly available here in the clinic. And I thought, man, what if I can get him fit today with this, the sleeve dome? So I put the sleeve dome on the hearing aid.

He was pleased with the feeling of it compared to the ear mold. But then, of course, my concern was, is this really plugging up the ear sufficiently for such a significant hearing loss? So we did run the real ear measurements, and he was getting enough gain to continue with the fitting with this particular earpiece. So, again, another option that I kind of wouldn't have thought about, but having the situation be as it was, I had to think outside the box and give him something to use in place of the ear mold at the time. And I knew that the power dome in the past hadn't been suitable for him.

So this actually did the trick and I was, was happy to be able to fit him that day with a temporary solution like this. So yeah, that's great. That must have been chosen. Yeah, that must have been a relief to have that when the ear mold doesn't arrive and we're all freaking out because the patient's there for the fitting. Right.

Finally, my last example of how an earpiece feels in the ear isn't another. It wasn't actually my patient necessarily. It was my brother in law that lives across the country from me but has this hearing loss with his permission, I could share. But the whole family had been annoyed that he couldn't hear for a while

and he finally, finally decided to get hearing aids. And then I noticed at a couple of, at a family wedding and in another event, he wasn't wearing them.

But I didn't want to, you know, be the audiologist bugging him. Why aren't you wearing your hearing aids? And I asked my sister and she didn't know. And he was just very grumpy. And so I finally said to him he was coming to Chicago for something and I said, oh, if you'd like, I can take a look at your hearing aids and your fitting.

And I found that he was wearing a skeleton ear mold, which I guess wasn't very comfortable for him, but he didn't even know how to articulate that. He'd never worn hearing aids before, but that's what he had been fit with and didn't like it and that's why he wasn't wearing them. So I switched it out to a power dome and he was just over the moon, so happy and has since called me a couple of times to tell me how much he loves his hearing aids. So really it just completely changed the fitting by changing the coupling. And before, as I mentioned, he wasn't wearing the hearing aid.

So sometimes the best coupling is the one that the patient will wear. Yep.

So those are great examples for fitting. And of course, once a fitting happens, then there naturally will be a follow up. And when there's a follow up, there naturally may be some complaints. So we're going to talk about earpiece selection for solutions or troubleshooting. So I identified some complaints that are not uncommon.

And I would think that all of you can recognize these. First, wearing the hearing aids out, there's a lot of background noise. Maybe being experienced, the hearing aids may sound sharp to the wearer. Streaming doesn't sound as good. So they're used to not wearing hearing aids and having their earbuds when they're streaming.

And now suddenly they're wearing hearing aids. And of course, we don't necessarily want people swapping hearing aids for earbuds. So we have the great technology to be able to stream through the hearing aids, but now they're used to the earbud sound quality. And here we are streaming through a hearing aid. So could be complaints about streaming and that they obviously background noise is a problem.

So even though the person may be right in front of them and they think they should have accessibility to their voice, it's just really difficult for them to hear a noisy environment. So all common complaints. But how can we address these without maybe changing the electronic components or the features to the hearing aid? Let's start here with the hearing aid sound sharp. This is one that I think someone put in the chat earlier and said, why do you try to fit everybody as occlusive as the patient will let you?

This is one of the reasons, is because there's a certain sound quality to, of course, an open hearing aid, and it can be sharp to people. And that could be because we are using, you know, the gain, and then we have the ear canal resonance exacerbating that could give it a sharp quality. We're not providing that full sound quality anymore with the lows, so we're taking that away. So I typically, if somebody will tolerate a more closed dome, I like to offer that to them so they can experience the more full sound quality and then also kind of knock off that ear canal resonance if. If possible.

And I just want again to point out that just changing the dome doesn't mean that you need to reach for the gain. So if someone says, this sounds sharp, sometimes I'll say, okay, well, let me change the earpiece. And then maybe it's just as easy as going to, like, a tulip dome or a closed dome. And then they say, oh, it sounds a little bit better. And I don't even have to connect the hearing aid up and start messing with the frequency handles, because if just changing the dome gave enough difference for them to notice the difference between the sound quality, making it less sharp for them.

So some patients are just tuned into those types of things. Yeah. And that brings to mind a patient of mine who had the exact same type of situation. This is a patient I've been seeing for years who's a composer in New York City. You can see him, the way he composes.

It Here with his computer and his piano. And he's very sensitive to frequency response and so forth. And it took us a while to fine tune his hearing aids exactly how he liked them. But he had reached out to me not long ago and said, everything sounds too sharp. And I didn't know what was going on.

That's strange. Nothing had changed with his fitting. So I met with him and took a look at his earpieces. He wears micro molds, and he happened to. At one point, we had done a select event, trying different events, but he was wearing the most occluding.

Select event, but they had come out of both of his molds. I think the vent plug came out. Yeah. Because it was a softer material, which I. So anyway, he.

And he really noticed that change because he went from being occluded to having, you know, a substantial vent. And it made such a difference with him. And it was, you know. So it's really a case where you can make such a difference by changing the venting, just as you were mentioning as well. Yep.

So actually, the sound quality and frequency shaping changes with the earpiece. So even though he didn't intend to change it. Exactly, he noticed it. So I think it's a great, great point what you said. You don't always need to go in and fine tune within the fitting software.

You might need to change the coupling or look at the coupling and see what's going on. Yeah. Great.

All right, so moving to the next one again, sort of. I think all of these troubleshooting techniques kind of help me make the decision to try to get somebody more occluded, if they'll let me. Of course, as Jill explained, their subjective components here, and they may say no way. So I have to take that into consideration. But this, the streaming doesn't always sound great.

So obviously, hearing aids nowadays are not just hearing aids. They are earbuds as well. And this is how we have. Are listening to our music. And that can affect the sound quality of the earpiece here.

So if you have somebody that's accustomed to using earbuds or just likes a good music quality, it may be a good solution to try to give them more occlusive fitting. And the reason for that is if you have a more open fitting, you have no attenuation of the outside sound. So, like, that passive filtering of noise is not happening that's going into the ear canal can affect the sound quality. It's completely vented. So as we looked before, we have the vent effect and that we could be losing the bass, which in listening to music, oftentimes we like that having the bass available to us for the sound quality of the music, then you don't have any attenuation properties of the ear canal.

So again, you might have that ear canal resonance, kind of making it a little bit pitchy for the, for the streaming as well. If you use like a more mid level, you have the tulip or a vented earpiece, stock earpiece, you do have some attenuation from the sound coming from the outside or blocking that comb filtering below 1000 Hz, you have the, the base from 1000 Hz and above. So a more bass effect than you would with an open. With the open you're losing, you're losing all the way, possibly even down to 2,000. And then you do have an attenuation property with some of these more closed earpieces.

I won't say completely closed, but more closed than open, about 10 decibels. So that just sort of knocks down some of that, that peakiness that you might experience in the high frequencies that's affecting the sound quality of streaming music. And then finally the power dome, which naturally, of the stock domes, we find this to be the most occlusive also, again, watch out for the variability, but this really is going to

block the outside sound from getting in. You're not going to lose that bass effect quality of having the cup with the lid and keeping that trapped in the ear canal and meeting the eardrum. And then we have the attenuation properties.

This particular documentation showed up to 16 decibels of that, that peak that you might see for an ear canal resonance. So kind of just smoothing things out, making it more even for streaming. I know this isn't the primary function of the hearing aid, but people do enjoy this feature. And the flatter you can get, the response, the better in terms of streaming, particularly music.

Okay, so the next is the. There's a lot of background noise. And again, this just having the ear canal a little blocked gives some passive noise reduction. And that helps when blocking out noise in a busy situation. So if they'll let you plug up the ear, you can get some more blocking of that outside.

And there's actually a study here that talks about the noise reduction from the hearing aid and then also the directional microphones and how there are benefits seen to have a more occluding fitting versus an open fitting just to kind of leverage those advanced features. So if you are providing hearing aids to somebody and saying, hey, look at all this, that the hearing Aid can do for you in a noisy situation. We have noise reduction to make things more comfortable. We have directional microphones to help you hear a speaker in noise. You really want to leverage those technologies if you can.

And then that could be by plugging up the ear a little bit more. That's a great point too. I think a lot of people don't realize that some of those features don't work as well in an open fitting. Exactly. So the next slide kind of goes hand in hand with the one that we're talking about here.

This one's talking more about directional microphones than the noise reduction. But again, same idea is I think that there has to be some awareness of how that ear coupling or the openness of the fitting affects some of the hearing aid features. This article I love. It's a literature review. I this is one of my go

tos, so I would definitely recommend this.

But it talks a lot about the different advanced features and then how you leverage those with your fitting. So this one's focusing on directionality. And really the moral of the story here is gain equals directionality. So you really want to make sure that you're doing your real ear measurements and you're providing gain. Because if the gain isn't really up to snuff to get that sound coming from the hearing aid 10 decibels greater than an outside sound source that could possibly be going through the open ear mold, you're really not going to see any directional benefit.

And again, a lot of times this is where the hearing aids, other than obviously amplifying sound, this is where you're trying to leverage the technology is getting somebody in a noisy, complicated situation better hearing. So this study is great to read for. This talks a little bit about how directivity is greatest at low or moderate input levels. That's because the gain is usually higher if those inputs, rather than we don't amplify loud inputs quite as much and then that's subject to the sound coming in through the open ear mold. So yeah, so just another thing, when you're talking about directionality, if you have somebody come in that says I'm really not hearing in noisy situations, like I would like to hear, definitely do the real ear measurements and make sure they're getting the gain because if it's really not there, then maybe closing up the ear canal can help them realize the benefits of the directional microphone.

Yeah, a great point, great suggestion. Yeah. So this slide's actually very similar but different to the last one. Again about directionality in the ear canal and sort of that passive path of sound entering through an open ear canal, mixing with the sound, the amplified sound, and just making sure that that directionality is accessible. So here we're looking at the red in the spectrum showing the sound coming from the ear.

So the red being the amplified sound and the black, I'm sorry, the other way around. The red being the direct path and the black being the amplified sound. You really want to make sure that that amplified

sound is overcoming the direct path in order to get. Get your. Your best experience from the hearing aid.

So I guess that question that was entered in the chat a long time ago, why try to use the more occlusive domes? For me, it's all these troubleshooting. If I can avoid these up front by giving someone a little bit more occlusion in the earpiece, I would prefer that. But, yeah, address the directionality issues head on before they can even happen. Yeah, exactly.

If that's something that we can do. So kind of wrapping everything up here. Just want to remind of the three principles. So getting back to the transparency, which is important. So how much is the ear canal representative or the dome representative of the open ear canal?

How much sound is getting into the ear canal from the outside, the vent effect, like, how much energy are you losing in the ear canal? So when we're talking about the lid, how much does the lid change the actual. The cup size, how much sound or how much is getting in, how much is getting out? And then, of course, we cannot forget that there's a person on the other side of these ear molds and hearing aids, and how much are they able to tolerate and handle a particular dome or earpiece? Because that is absolutely important to make sure that they're happy with it as well.

So blending these three things together and kind of, again, hitting the bullseye, I love that. And then also just really kind of to remind you that you can use the earpiece selection to your advantage, because obviously it's going to affect, as we learned about through this presentation, not only sound quality, but gain and how much directional benefit you're getting. Have to take things into account, like comfort and cosmetics, as well as, like, another noise reduction and how natural the sound quality is and then overall, the flexibility of your fitting. So hope you hope you learned a lot and learned maybe new ways to think about your fittings and how you're selecting couplings for the hearing aids. Yeah.

So it definitely has a bigger impact than I think, maybe seems at first glance. So thank you. And it looks like there's a couple questions. Yeah, let's see. See if I can scroll back.

Okay. One, from your experience, what was the most. What was the common dome used to help patients understand better in background noise? So if we're talking about the studies specifically, this was an occluded fitting versus an open fitting. So, you know, maybe more extremes there.

But I just like to say for my experience, I don't know if there's a most common dome, but if I can get somebody, if I know that they, I would naturally want to fit them with an open. I'll try to step it up, you know, maybe one or two steps. So I may be. Not necessarily going to say, oh, you have fantastic low frequency hearing. I'm going to give you a power dome.

But what I would normally do is say, okay, I could probably get away with an open dome here, but let me try them, you know, in, in something like a closed dome and see if they'll, they'll, they'll be acceptable to that. So let them feel that out. And if they're not opposed to it, then I would go with that. So I'd almost like to try to. If we're talking about occlusion and sizes, I try to size up two sizes, if they'll let you.

And then see if, if I can get away with that. Yeah. And another question. What is the best way to choose venting? Sizing for a patient who is very sensitive to occlusion.

And I. This is where I think something like a select event really works great. Because maybe you might need to have them work up to like you were talking about, working up to a more occluded fitting. But you could start open and then change it. But just have to be careful after my experience that that vent plug doesn't fall out.

But yeah, I think that's a nice flexible. Be able to change your vent size. Yep, absolutely. And with that, I think we're just about out of time and we'd like to say thank you. And if you have any other questions, please feel free to reach out to us through email if you'd like.

Yep. Thank you again for sharing your lunch break with us. Appreciate it.