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- - [Lisa] Good morning, everyone. It's morning still here for me in Texas so I wanna welcome you all to our class today for bone conduction solutions for children with hearing loss. We have a whole lot of information this morning, so I hope you all find it useful. I hope there's some people who are passionate about these bone conduction solutions as I am, and so let's get rolling. On the agenda today, we're gonna talk about kind of four main areas. Conductive and mixed hearing loss in children, single-sided deafness in children, advantages of bone conduction solutions, and then fitting those bone conduction solutions. And hopefully, with time allowing, we'll hit a couple of case studies at the end. And so just real quick, your learning objectives that we have will kind of coincide with our objectives that we had earlier. So hopefully you will all be able to achieve these four things once the course is over. So first, let's talk about conductive and mixed hearing loss in children. If we think through, kind of back to our classes in our programs in college, we think through about these conductive and mixed kids kind of in one pod for today. So the prevalence of the conductive hearing losses can be up to 3 1/2% in the general population and so we know we also classify those into two different categories, permanent or temporary.

Those causes, we all can kind of go back and know those causes. Microtia, atresia, otitis media, some genetic syndromes that definitely may or may not have atresia or microtia, but definitely have a conductive or mixed component. When we look at the two, and I know we're all guilty of this, I am as well, of just saying atresia a lot of times, but we really, in order to break this down a little bit more clearly, we need to kind of think through both things of atresia and microtia. And so I have these listed out for you today. So basically, microtia is just any kind of deformity of the outer ear. And our surgeons and our physicians put grades on those most of the time when you see them, grades I through IV. And you will know that III is the most common and so it's that kind of peanut kind of shaped ear. And five, the complete anotia, no outer ear present is that least common in the microtia group. So treatments in those areas are, a lot of times, surgical reconstruction, but there also can be prosthetics. And then if you kind

of flip sides and look at the atresia side of things, that is just purely the absence or the closure of the external auditory canal. It is also classified by likelihood of repair based on the score of one to 10. You can do a little research on that on the side if you've never read about that. It's kind of interesting. But eight out of those 10 will equal an 80% chance of hearing restoration. And so they will usually do surgical repair on these kids who have atresia somewhere along the age of three to six, just depending on where you are. In some areas, I've seen people who push that up a little higher, even to seven or eight for generally both surgeries, but it just depends on your surgeon and who you're working with and their comfort level. So when we look at chronic otitis media, the children most at risk for hearing loss due to otitis media are those with a chronic form of the disease. And basically, we know that about 60% of kids with chronic otitis media will have some sort of hearing impairment. Now, those of you who are in a busy ENT clinic with pediatrics like I am many days, you'll feel like that's 100% of those kids that come in with any sort of otitis media have hearing impairment, but we know from some of our research that it's 60%.

The rate of otitis media is estimated at 3% in North America with about 22 1/2% of those occurring children under five, which, again, if you are in a clinic like I am, you'll feel like it's much more than that some days. Another big concern that we have with kids, especially, is a fluctuating hearing loss, and otitis media can fluctuate, especially in childhood. Note there where we have documented that 29% of children with Down syndrome have a permanent, mixed, or a conductive loss, but another 32% of those kids have fluctuating losses. Those are super hard to kind of keep a handle on. And if you're fitting those kids with BTEs, which may be preferred for the patient or the family or something else, as we kinda go through this, keep those kids in the back of your mind because if you've got a fluctuating air conduction loss and you can put a Baha on that and it's not the bone conduction that's fluctuating, it really takes a lot of guesswork out with some of these kids, especially those with Down syndrome which happen to be some of my most favorite patients and sometimes they participate well

and sometimes they don't in our testing. So those are always fun and a good challenge. Also, for fluctuating, definitely children with cleft palate. So we estimate those in the population for about 10%. Another big piece here are genetic syndromes. CHARGE syndrome, definitely hearing loss might be mixed, conductive, or sensorineural and it can range from mild to profound. Treacher-Collins, probably what everyone thinks of for the most part when think of a bone conduction device, but it's conductive hearing loss with craniofacial abnormalities. We also look at things like Branchio-oto-renal syndrome which also can be conductive, mixed, or sensorineural, and then another good one to look at with these cases is Stickler syndrome, which also could be any of the range, conductive, mixed, or sensorineural. So one of my favorite things to talk about is single-sided deafness in children, and I'll try to not get us stuck here today. It's definitely one of the things that I most like to work with.

So we know that since the onset of the universal newborn hearing screening, it's led to some really early identification of SSD, but quite frankly, we are still kind of unclear on our management for those kids. It seems to have lagged behind newborn hearing screening. What we do know is the prevalence estimates for SSD are about one in a thousand at birth and rising to about 14% of adolescents. Some of those from the sudden SSD that sometimes children, adolescents, and adults experience, but what we do know a lot about is untreated SSD. So untreated SSD in childhood can lead to delayed speech and language development, behavioral concerns, and definitely academic concerns. So when we look at treatment for SSD in children, what we have, there are some guidelines, some amplification guidelines from the Academy. And it doesn't really specify treatment options for kids, but we do talk about how children with aidable unilateral hearing loss should be considered candidates for amplification due to this evidence and support for potential developmental and academic delays. Where we kind of move in that difference, which I just said is, our treatment options for those kids. So we look at things like monitoring with no treatment. We look at classroom accommodations. We look at hearing aids. We look at bone conduction

technology. And I will tell you from a clinical standpoint when I sit in a room with a family, even with a tiny baby that we have found SSD in, I kind of go through this gamut, almost like just a spectrum of what we can do. And at first, as always, we could do nothing. But that doesn't come without some indications and without some talk with the parents and the family about we know that there is a high potential for speech and language delay. There's a high potential for academic delays. And then we move through to, we can do classroom accommodations, but if you've got a three, four-month-old baby that you've identified, those classroom modifications and accommodations can be way out. They can be four or five years out before we're looking at those. And so I think that's another kind of counseling point to hit with these families is, so basically, classroom accommodations are do nothing until school. And so that's kind of a hard, it's a hard thing to talk through and to push out the importance of that at a certain age. I like to sit in, like I said, go through just the whole gamut, even if they're really young. I know, like many of us, as a parent myself, sometimes when there's something going on with one of my kids, it takes me two or three times of a conversation to get to that point of understanding and knowing exactly all the facts, especially if it's a foreign area such as hearing loss to many of our families.

So let's talk a little bit about bone conduction solutions. First, we will kinda get all on the same page here. So many of you know that bone conduction treatment has different forms for hearing loss for decades with the invention of the Baha about 30 years ago. This type of treatment was brought to more patients than ever before. And the Baha System was used to treat conductive and mixed losses pretty early on as well as single-sided deafness. And so you can tell here, two great graphics to kinda show a little bit about how it's direct bone conduction on conductive and mixed and then how on single-sided deafness, it kinda transfers that sound across. So using the microphone on the poor ear to help alleviate some things like head shadow and to put a microphone on that other side. So if we look at our technology foundations, it's pretty important to kinda know that our Baha System was born about 40 years ago in the

early 1970s in Sweden. And what was discovered was that titanium, if left undisturbed in the bone, would form a bond that strengthens over time. So the test of how well the implant integrates with bone conduction was tried on dental implants initially. And so one dental implant actually had hearing loss and was stunned to know that they could hear through that. And so in 1995, the FDA cleared the Baha System for use in the United States, first for patients with mixed and conductive hearing loss and then in 2002 for patients with single-sided deafness. Today, there are about 40,000 people in the US who use the Baha System to hear. So as we talked about, the Baha technology is dependent on the property called osseointegration. That refers to the phenomenon of living bone bonding with titanium and making direct bone conduction possible.

This is what makes the Baha System a unique treatment option for your patients. And without this type of integration, the implant would be in danger of falling out or vibrating out of the bone but because of this unique integration with the bone, titanium implants are stable and long lasting so patients are provided a lifetime of hearing with their Baha System. So why bone conduction? Your patients have many different options when they are, to treat their hearing loss and often, hearing aids are an option. So middle ear implants or ear construction also may be possible, just depending on the cause of the hearing loss. So let's take a little time to consider the unique aspects of using bone conduction to treat mixed and conductive losses and for single-sided deafness. So first off, the bone conduction system does not depend on the outer or middle ear because it stimulates the cochlear directly. That direct transmission gives the power needed so that your patients can get and hear what they're missing. So thanks to non-surgical options, we can do things like preoperative testing and know how someone will do after surgery and so that we can make some really great, some outcome predictions for both patients and their clinicians and, when we're working with families, for the families as well so that they understand what's possible postoperatively. The Baha has a really high comfort wearing system being that there's nothing on the ear and they typically are routine outpatient procedure, which is great

for families who are concerned about sedation with their children and hospital stays. So we can get a very predictable outcome with these using preoperative testing. SO let's look a little bit about what Cochlear has to offer on different systems for patient's needs. So one of the Baha System's greatest strengths is that it's not a one size fits all. It is a different system. So we have the traditional Baha Connect system which offers the best possible sound transmission that we can do through osseointegrated device. There is also the Baha Attract now, which you will see goes through skin and utilizes a magnet. You'll also know that the Baha Attract takes some advantage of that same osseointegrated implant that allows for excellent sound transmission even through the magnetic connection. And that also means that someone with a Baha Attract may have hearing loss that may get poorer and they may require a little bit more sound gain and then, in that, which you can switch back and forth with a minor change back to the Connect if needed in the future, so a great system that can be interchanged surgically if needed. And then we have our non-surgical Baha Systems, which many of us in pediatrics are very familiar with 'cause those are what we're using right out of the gate on our infants and toddlers.

So at the very top there is the SoundArc, which offers a newer, discrete, kind of more of a stylish alternative to the Softband. I've been working with Baha for a long time and I know that's one of the things that often families of young boys were concerned about is how are we gonna wear the Softband out there? Everyone's gonna call him a girl and so definitely, just from a cosmetic standpoint, many families that I've worked with over the years have been super hesitant about starting kindergarten wearing a Softband, and the SoundArc is gonna provide a great piece for that. And then your traditional Softband there on the bottom, which is what we use generally for our youngest of kids. Soft, elastic, easy to wear for those younger kids, especially as they grow into toddlers. So let's look just a little bit at our Baha System candidacy. As a reminder, there are two main groups that can benefit, those with conductive and mixed, and then again those with SSD. So the Baha System can fit either of those choices, and we'll kind of roll

through some of those. If you looked at conductive and mixed, we're looking at pure tone averages equal or better to 65 there across from 500 to 3000. And for our bilateral settings, we are requiring pretty much symmetric. We'd like those to be within about 15 dB to get your most optimal results when working with these kids. And when we look at single-sided deafness, we are looking at a profound sensorineural hearing loss in one ear and very normal hearing loss in the other ear. It's important that we discuss that today and mention again that, even though the FDA has cleared surgically solutions for Baha, it has cleared those for age five and older. And so in order them earlier, we need some of those non-surgical options that we will continue to kinda look through. Another way to look at these three different types of indications. We can break them down by type. So the first one, let's look through the candidacy criteria with those of mixed and conductive hearing losses.

So if we look at the Baha System candidacy for conductive or mixed hearing loss, the issue with those is the outer or middle ear typically. And so the Baha works by passing through these directly, stimulating the cochlea. Some of the common forms of conductive or mixed hearing loss than can be treated with Baha that we've mentioned before include atresia, chronic ear disease, cholesteatoma, congenital abnormalities. And these can be especially great for patients with draining ears. Baha can be a fantastic option over hearing aids for those because we are bypassing that middle ear space and the Baha device will close that air-bone gap, but because of advancements in technology over the years, we can do even better than that now and amplify sound for a sensorineural component and a mixed loss. So that means that your Baha device can give you a significant, can treat a significant mixed hearing loss without needing to account for the conductive component as well. So getting kind of conductive and mixed right there, all in one. So the Baha System, also, if we look at it versus hearing aids for conductive and mixed loss, we know it's an excellent option for hearing loss. The greater the air-bone gap, the more Baha will tend to perform better and outperform hearing aids. Hearing aids as helping solutions tend to have equal outcomes for

air-bone gaps, about 30 dB or less. In those cases where a Baha may be chosen in the lesser case with a lesser hearing aid, a Baha could be chosen, maybe because of a draining ear or maybe just a patient preference. Always give patients and families those options for when they have a usable ear canal without drainage. Here's an option of what you're gonna think. You can let older kids who come in, you can let them try each of them on. It's a great thing about using a Baha System and being able to program a hearing aid as well. You can go through and use both and for, like I said, older kids who can give you a little bit of feedback, they can talk through that with you. So let's think a little bit more about hearing aid fittings and how they can be a little challenging for mixed to conductive loss due to the amount of gain required. So why is that the case on those? Let's take a little bit of a closer look.

So Baha System advantages for a conductive and mixed loss. Well, first, we all know there's nothing worn in the external ear, which is helpful in cases where there's drainage. It's also helpful if pinnas are misshapen. Any of you who often try, because if parent or physician request or other issues, it could be funding, reimbursement. There's all kinds of issues that you could get yourself into where you're trying to look and make an ear impression on a kid whose pinna's malshaped. So there's definitely a bonus there for using a Baha system. It's a little bit easier to work with than sometimes those ears that have been surgical or very sensitive. I have a kid who I actually did impressions on a couple weeks ago and who really was, has a lot of discomfort because of a past surgical ear whenever we do impressions. Kinda keep that in mind, we have some misshapen pinnas. Also another advantage is a Baha doesn't need to be readjusted if air conduction thresholds fluctuate. That's what I was talking about a little bit earlier when we were talking about Down syndrome kids or kids with cleft palates who, that level of air conduction is constantly fluctuating due to middle ear or some of us see a really wide variety of patients and sometimes they just have some fluctuating hearing. It's always nice to use a Baha System when it's that air conduction fluctuating. And also another big advantage is what I mentioned before is we can

always do preoperative testing and we can predict postoperative benefit with that, which is very nice. You can sit in and show families. You can show patients if you see older kids or adults. You can give them that information prior to the surgery and prior to even ordering sometimes. So use of the Baha is also associated with higher user end satisfaction and good long-term benefit. And there's some references there. You can go check those out. The theory is, we're using what they have. We're just helping what they have instead of trying to drive a hearing aid past that system. A lot of people, even kids, can tell you pretty quickly that they like the sound of that better. So we're back our system candidacy, and we're gonna take a look at single-sided deafness. So would we look at this in terms of the Baha System with candidacy. Think about patients with single-sided deafness. They're missing the advantages that two ears provide. If you remember, there are kind of three main disadvantages, or three main advantages of listening with two ears. First is overcoming head shadow effect.

The head shadow effect is illustrated here in this picture, and it's especially true in the high frequencies. If you can look in this example, the sound is coming from the left side of the person's head, and you can see that, especially the high frequencies don't really make it to the other side of the head. Having two ears means that you always have one ear towards the sound and you can hear the complete signal. Our brains use this difference in information coming from both ears to help us better with background noise. If one ear's not picking up sound well for the brain, then it becomes quite difficult to hear in a noisy situation. And finally, our third advantage is that two ears help with the localization of sound. We use both ears to find out where the sound is coming from and these are the main challenges faced by someone with single-sided deafness. So when we look at treatment options for SSD, what are the common treatments for that? We've gone a little bit down that road, but unfortunately, the most common treatment is to do nothing. That first kind of place on the continuum we talked about before. So this is sometimes the patient's choice. It sometimes is the family's choice. Sometimes, as many of us know, it's the physician's choice to decide that they

don't feel like this is something that they want to take the family down the road of or maybe they don't understand the Baha System. But either way, our largest and most common treatment is do nothing at this point still. So there's also CROS hearing aids that probably are the next most common choice for patients. There's been some significant improvements in CROS technology leading to more patients using them but they do still have some limitations, which we will consider. And then finally, our last treatment option we're gonna talk about today is the bone conduction devices. So advantages of bone conduction for SSD. Let's think about we we should use it on the front part here. So when someone has a complete loss of hearing in one ear, we need to find a good way of transmitting that signal from the normal ear, and the bone conduction is a really great way to do that. So with the Baha System, on the poorer ear, the sound is transferred across the head to the normal hearing ear, leading to several advantages. First, it's improved hearing in noisy environments by reducing a head shadow effect and bringing the sounds to the brain from both sides of the head.

So thinking just like hearing aids, microphone on both sides of the head, one ear is a microphone, the other's a real microphone for your Baha, so thinking in terms of things that are miced and having the input from both ears. When you're in noisy environments, the lesson, patients are able to hear. It's really hard to hear in group conversations. We all know that, even for normal hearing sometimes. When we take one ear out of that, it makes it even more difficult. And we all know that, unfortunately or fortunately, depending on how you look at it, classrooms are extremely noisy places. We want them to be full of energy, we want them to be a great learning situation, but that also puts a lot of our kids with SSD at a disadvantage because school is a very noisy place. And so what our studies have shown is that the Baha can help reduce some of these consequences of living with hearing loss on one ear. It can do these things like improve speech understanding in noisy environments, lift the head shadow effect and reduce these psychosocial consequences associated with hearing impairment. And we have some long-term patient satisfaction and hearing benefits.

You can tell, there's a nice little graphic there. So when we talk about bone conduction versus CROS. So a common question many of us who do a lot of bone conduction are asked is why a patient might consider a Baha instead of just using a CROS and how that benefit might be different. So while there are many patients who elect to use a CROS, and especially a BiCROS, there are some reasons why a Baha might be a better option. And basically, the main reason is that the Baha System can be very discrete. Patients love that it doesn't require them to wear anything on their normal ear. A Baha also allows wireless streaming with the environmental mic from the environment, and the bad side. Also many CROS require turning off the mic in that ear in order to utilize the wireless technology. And the Baha 5 systems are the first made for iPhone solutions for individuals with SSD and allow for easy streaming from iPhones and other wireless devices.

They offer a seamless hearing experience for those patients that use them. And the Baha, from patient report many times is classified and called a crisp, clear sound that is given when it bypasses the middle and outer ear and it doesn't need to be, you don't need to overcome any occlusion effect, and that's really easy to work with with these kids and adults. Whoops, sorry, and finally, speech understanding and noise has shown some better understanding in noise with the CROS hearing aids. Also like to kinda throw a little other piece into that is that when we are catching kids on newborn hearing screening and we're moving to these things like non-surgical bone conduction we're moving into now and we choose that six months when we're ready to move into action with these kids, if we don't choose do nothing, then I don't think I would ever put a CROS on a six month old. So if we really wanna kinda start that path and we wanna start them into hearing and trying to get some better head shadow, better listening and noise, all those things, probably not gonna do that really young with a CROS system. So kind of keep that in mind as well. Baha Systems for non-surgical. Prior to age five, the only non-surgical available alternatives for children are the two on our slides. The Softband is really ideal for babies and toddlers. It's soft, it's elastic.

Many times, those of you who work with these devices, we actually clip the retaining device to the Softband. Softband's pretty easy to find than that little Baha 5 if things get knocked off or lost or pulled off in tantrums. We all know those happen and as parents and as audiologists, so those are often great, the Softband, for those younger babies and toddlers. And then the Baha SoundArc, very effective and a stylish alternative now for those younger children, especially ones who would like a little bit more discreet, little bit different way to wear things, and it's just really and truly, using one of these systems on the front end is a natural progression from non-surgical to surgical options and it gives them very consistent and reliable access to hearing. So we continue looking at these. There's a little bit of information here at this, your non-surgical options. Generally, these are used for three main reasons. First, they may be used preoperatively to help test pre and post benefit. That's adults and children alike.

Second, they are used for children under the age of five who do not qualify for a surgical option, and as we discussed in our candidacy module, the surgical options are only cleared in the US for children age five and older. So younger than that, they would need a non-surgical option. And finally, these non-surgical options may be used with older patients, perhaps elderly patients who are too medically fragile for surgery or patients who are in between surgeries and wanna try the Baha for a long term before deciding to proceed with surgery. And again, just the goal of these two options is just flexibility. It gives us a really great flexibility to be able to use one or the other in any of those three conditions. You can see from the output graph there, the output for both options is essentially the same. So the choice really comes down to lifestyle and the cosmetic concerns that they might have for the patient. And the Softband's a wonderful choice, again, for younger children and infants. Easy to keep in place, soft, comfortable, that sorta thing. And then as the children get a little bit older and they might wanna try a different way, the SoundArc has definitely been a cosmetically appealing choice for those patients. So the SoundArc, let's take a little bit closer look

at it. I actually kinda love the choices there on the SoundArc, the soft silicone tips are comfortable and they're a snug fit. We were lucky enough at Children's to participate in a study of the SoundArc and I didn't really have any complaints about that. Parents felt like they stayed in well, and the fun part about it is that you get some good retention from that, sometimes a little bit more than they wanted. Some of the kids, I think, were used to kind of jerking the Softband off. It's not as quick of a jerk of the device to get this off. Pulls a little bit so it keeps it on sometimes a little bit better. And I love that it's got a nice custom fit steel band in the back. You can manipulate this and move it as you need to to make sure that it fits around the head. I was told when it first came out that I couldn't break it. I tried very hard. I've bent several of them many, many, many different ways and they are right, I have not broken one yet.

So very durable in that aspect. And the connector disc allows some easy attachment to the Baha sound processors and you can tell that it's compatible with the Soft Pad which we'll discuss a little bit more in a moment, and it provides the best possible sound for the patient. As a pediatric audiologist, I love the colors that we put on those. They can match hair, clothes, moods, anything you'd want. And I did have several girls, before we got our colors, asking if there were pink and other things because they would see other devices, other hearing aids and all the fun colors. And so always great to have those options for our kids. So now let's look a little bit at our Softband. If you looked closely at that graph, there's about a three, 3.8 dB better sound transmission if you're wearing the Soft Pad compared to wear without the Soft Pad. And you'll also notice non-latex, so that's new of the last few years as people are more latex allergy conscious. And you'll tell there are some great colors as well, an adjustable strap that's on there. Usually the moms, when I'm like, it's like a bra strap, they get that really quickly, dads not so quickly. So it's easy for them to figure out how to maneuver that and make it larger or smaller as they need for their babies. And there's a safety release for peace of mind should you be worried that the device would get tangled in any way on a young child or an infant. The connector disc there, again, same way, also a secure

connection for the Baha 5. And just so that you don't forget, there also is a bilateral option available. So we talked a little bit about, a little bit more better, a little bit more better, a little bit better sound transmission with the Soft Pad Wear. You can see on there that, basically, it was just designed to reduce pressure that could be on the head from a magnet or the non-surgical connector disc. And so if you've seen a lot of young children maybe without a lot of hair or any little bit of extra support there, you might have had a patient say or a mom be concerned 'cause it looked a little red after a little bit of time of wear and you can very well put a Soft Pad on there and that helps to make sure that that pressure isn't there and it helps to ease a lot of parents' minds, especially working with the little bitty ones wearing these devices. And so if you look at the two images here, this is a look at the pressure with the SoundArc that has the SoftWear Pad and one that doesn't.

Darker yellow and red color, the higher the pressure. So because of the small differences in the contour of the head you can see, on the right hand side that without a SoftWear Pad, there are hot spots or places that there may be some increased pressure on the head. These might be small differences, but over time, they can make a little bit of a difference to the comfort and the overall wearability of the device. It's designed to reduce that pressure and comfort, and so attaching it or moving that SoftWear Pad on the SoundArc and the Softband is just like doing it with a Baha Attract. We would recommend changing it regularly, especially if it's been worn or soiled or in the case of some of our babies, chewed on 'cause that tends to happen as well too, so always keep that in mind that it can be changed out pretty frequently, as much as needed. Just another look at both options here. The SoundArc on the left, oops, sorry, hit that a little too fast, has the blue-colored tips. Can also be swapped out to blend with anything else, but just another little cute pic there to see how we're matching everything up. Now let's talk about surgical bone conduction solutions for just a few minutes. We know now that the Baha Attract clinically has been proven and works similarly to the Baha Connect, and we'll go through that just a little bit more in a

second. So if you look down the side there, the Attract has the extra magnet inside that we briefly mentioned earlier, and the Baha Connect with the direct connection. So the Baha Connect giving the most direct and the most maximum gain possible. And the two systems have the same one strong foundation and osseointegration. So you can tell, here's a picture of a child in an Attract. So you can see the magnet sitting on the outside there, and knowing that the internal and the external magnets connect. It's comfortable, easy to use and care for. It's designed with some MRI safety in mind, which a lot of families ask for, especially some of our kids who have other conditions and might need to have MRIs for reasons along the way. If you look here, you get a little bit better look and view at the internal and external pieces and how they connect together. And then looking at the Baha Connect. It uses a small abutment, provides that direct connection between the sound processor and the implant, also safe for MRI there. Does require some daily cleaning and care, so definitely something you need to add to your counseling list if you have a family who needs a Connect or a surgeon that prefers the Connect for a certain patient. It does take a little bit of extra counseling just on the front end to talk to the families about.

It will have some direct contact and you're gonna wanna make sure that that's cleaned daily and taken care of and so just some extra time maybe to include that in your Connect cases. So surgical details, let's take just a moment to discuss some of the key details around the surgical procedure. We're not gonna go into depth about how the surgery is done, but I do want you to have some information that can be used in counseling for patients. So it is an outpatient procedure, quite fast for the Baha Connect, often 15 to 20 minutes and usually under 45 for the Baha Attract. Especially the Baha Connect, surgeries can be performed under local anesthesia, mainly on adults, but it is possible to do a two-stage procedure if there are concerns about bone quality. That could be true for younger children, especially over patients who have had radiation treatment or other bone conditions. A two-stage procedure is where the implant is placed and then the abutment or magnet is placed in a second procedure

after the osseointegration has occurred. But most of the time, the surgery is done in a single stage and fitting takes place at a later date. For the Baha Connect, the fitting is FDA cleared at 12 weeks after surgery. For the Baha Attract, the time the FDA recommends is four weeks. So success rates for Baha surgery are very high and complications are rare and usually minor. Surgeons are provided with support for surgery whenever and wherever needed. And after the implant site is healed, usually within a week or so, that is, it's usually healed, the patient can return to all normal daily activities. With the Connect system, they do have to clean and maintain that site area, but really no more complicated than brushing your teeth and you all, if you've worked with the system for awhile, know that you get a nice little soft brush to do these things with. And with the Attract, the skin heals as normal after any type of surgery. So why consider a surgical option? If you have two non-surgical options, why would you go for the surgical option? Well, there's a few reasons. One, the main reason being sound transmission. It will always be better with a surgical option, whether it's Connect or Attract.

The one thing we like to say is that if you like the SoundArc, you'll love your Connect or your Attract. And this is because patients generally have lower thresholds, especially in the higher frequencies with a surgical solution. The graph here that we have illustrates that for us. It's comparing thresholds for the implant in blue, the Testband in pink, and Softband in yellow, and the test rod held between the teeth in the light blue. And something we'll talk about a little more in candidacy module as well. You can see that the surgical option consistently provides the lowest hearing thresholds, especially in the higher frequencies. The surgical options are comfortable to wear as well. With no concerns about placement, you can imagine a child in the elementary school taking a SoundArc on and off during the day, as the Connect may have a little bit more of an issue getting back on for younger children. But finally, a surgical option can provide more discretion, which is super important sometimes to many of our families and a lot of our older kids. So most patients like that because it completely hides in the hair. So

let's look through Baha 5 Sound Processors. So they are smart and they're small and they're powerful and look so different and so great than they did maybe a few years ago for some of you if you're getting back into Baha again. The goal of the Baha 5 series is, of the Sound Processors, is to provide professionals and patients across the widest portfolio of processors in the industry. And you often need to have choices when you're fitting patients. The Baha 5 Sound Processors are designed to give you that choice and flexibility. From the smallest Baha 5 processor to the most powerful, and we'll take a little peek at how those line up here. So if you look at the Baha 5 portfolio, these are the fitting ranges for each of the devices.

The processor selection should be completed by comparing the bone conduction thresholds or better yet, maybe using BC direct thresholds if you've got the software opening and are doing that preoperatively to find the fitting range. That Baha 5 Sound Processor, the smallest one there at the top, provides a smaller and smart option for those with bone conduction thresholds closer to normal up to about 45. The Power device, or the Baha 5 Power can be used with those patients with bone conduction thresholds up to about 55. It's a very powerful output and matches other super processors. And finally, Cochlear has offered a head-worn sound processor with the microphone and transducer separated. And that Baha 5 Superpower combines the technology of the cochlear implant and the Baha that provides significantly higher gain than any other device, fitting bone conduction thresholds up to 65 dB. So for individuals with severe to profound mixed hearing loss, this may be the only option. And yet it provides all the connectivity and the ease of the other Baha 5 processors. So something for everyone across the spectrum here. So let's talk a little bit about connectivity. So when we look at smart connectivity, we mean direct to device communication through Bluetooth smart technology. Apple has further designed this technology for their devices and Baha 5 Sound Processors are the hearing implant industry's first made-for-iPhone hearing devices. So this exclusive technology allows Baha 5 system users to stream phone calls and music directly from their compatible

Apple device to their sound processor with enhanced user and feature controls. Some of those controls are live listen, which allows for the iPhone to be used as a remote mic, and the made-for-iPhone hearing device really has nothing to do with the app compatibility and cannot only be done with Apple devices. And so we'll talk a little bit more about that soon. So the first smart app for bone conduction. So to assist and help optimize all of the hearing experiences, Cochlear has offered a Baha 5 smart app as part of the industry's comprehensive app portfolio. So the Baha smart app is available for both Apple and Android compatible smartphones, so it's iPhone 5 and iPhone 6 and then Samsung 6 and seven has been verified. So all four of those verified. And it gives users improved control in monitoring for their Baha 5 Sound Processor. So it is possible to stream directly to the sound processor with an Android. Apple streaming is done to be made through iPhone hearing device technology. So if you need some more information about a little bit of how both of those work and maybe some help troubleshooting through that, I am quite sure your local reps and others will help. It's pretty easy to do. If you look at True Wireless Accessories, those are in addition to the iPhone connectivity. So all the Baha 5 Sound Processors can be used with Cochlear's True Wireless Accessories.

The Mini Mic, the Mini Mic 2 are available as remote mics and they can stream directly to the sound processor with no necklet needed. The TV streamer is also connected to patient's television. It can provide direct signal, and it has a range of about 23 feet. The phone clip is available for streaming phone calls and listening to all Bluetooth-enabled devices. And it's a great option for individuals also with an Android device. So FM capabilities that's something that we ask a lot about in the pediatric world. And so for children, FM compatibility in the classroom is critical. Talked about noisy classrooms earlier. And with the Mini Mic 2, an FM receiver can be plugged into the bottom of it. So you can see a little picture there at the top. And that allows for the child to hear the teacher's voice directly in their sound processor using that Mini Mic 2+. So tips for fitting Baha in children. Use for wearing Soft Pad. It's designed to reduce pressure. So

if you can use that, small differences on the contour of your head like we've discussed before, it's just really great, especially if you have parents who are worried or children with sensitive or fair skin where it gets red really quickly. It's a great option to put that on there, especially if there are some kinda hot spots noted by the patient or the family. Also use it on the SoundArc, which is probably the most common place to use it, the SoundArc or the Attract, but you can also use it on the Softband, so don't forget that as well. So adjusting the Softband. I know I kinda told you this before. I always tell my moms, "Adjust it like a bra step." And they get that directly. So there's your fun tip. Sometimes know your audience before you use that one. But you tighten it with one finger and can move it, slide it back and forth. Really easy to do. Adjusting the SoundArc. There are a couple ways to do that, and this is a little bit newer, so let's talk about this one a tiny bit more. So you fit to the head. It is a little more complex. So there are a few tricks to get it fit just right.

The first is to make sure that the soft tip rests comfortable just in front of the pinna. You can see there in the picture with the check mark. If they are farther back or are much farther forward, then you need to switch to a different size SoundArc. It now comes in extra small, small, medium, large, and extra large. I know many of you out there were waiting on that extra small as I was. We can use those, the different sizes and kinda fit as we need. So the next step on attaching the sound processor. Definitely always kinda come in at a little bit of a sweeping angle. Can be attached to the Softband, the SoundArc, any of the ways that you do it using that same Baha connector, and again just ensure that the processor isn't touching anything else like the pinna, maybe glasses, hats, et cetera, when you place it on the head so that you don't get any feedback. And let's spend just a couple seconds to chat about bilateral fittings. If we look at the audiological indications for that, we're looking at bilateral, mixed, or conductive. We're looking at less than about 10 dB average between 15 at different individual frequencies. So pretty symmetrical hearing. And our common causes, again, are those bilateral microtia and/or atresia, ear canal stenosis, and our

pretty standard, any Treacher-Collins kid that we're using for both the ears. What we do find when we fit bilaterally is the ability to localize to sound. I think that sometimes there's a lot of assumptions that bilateral bone conduction, sound crosses over easily, but there's really no true sound localization. There are several studies which have demonstrated localization is possible with bilateral bone conduction. I'd like to focus on a recent article that demonstrated here that the majority of bilateral Baha recipients are able to localize sound within 30 degrees, which is much better than the level of chance demonstrated with those with unilateral treatment. So definitely keep that in mind when you're fitting. Always fit bilateral when you can.

I know that microphones on both sides of the head and it's definitely, we are emerging on some really nice data that shows that this really is making a difference. Improved speech and hearing with noise. Same couple of articles there for you to look at when you have a little reading time. But up to 3.1 dB improved SNR when going from unilateral to bilateral. And definitely improved audibility with bilateral as well. So up to 5.4 dB in the summation effect. And again, some other references for you to check into later. So we're gonna do a couple really quick case studies here. First one is Manny who has bilateral microtia and atresia, diagnosed at three months of age. Well, probably diagnosed with the levels at three months of age. I like to say these are some of our easier and quicker to fit kids, as that, generally when there's microtia and atresia present it takes a little bit of ease out of the diagnosis and some other things when the parents can physically see that. So a lot of times, these are a little quicker to fit and I love that these kids do great when they're fit earlier. So he's been followed up through the first five years of his life. Here is his audiogram at 12 months of age. Using VRA headphones, obviously, supra-aural and good reliability for him. You can tell there's his speech for us. So blending right in there and fitting the whole picture for us. And just some kinda things to think about. So what would've been the best option for him at three months? Well, the Softband, right? Would you have fit him bilaterally at three months? I probably might have waited a little bit for a little bit more head control, but I

definitely would've ordered and ran both through insurance based on need. And then sometimes, during tummy time, things like that we have family slip up and put both of 'em on. It's easy to do to slide one on and off. So we think through what other options does he have? What are the pros and cons? All the things we've talked about today. So what options does he have for treatment as he grows? Well, if he started in a Softband, maybe he gets to school age and he would like to move to a SoundArc. And then maybe after that when he's ready, surgically ready and audiological ready and family and him are ready, be time to move on to implantation. So here we kind of run through, this is exactly what happened. So hopefully we projected all of the things that were there. Got a Softband at three months, fit bilaterally at 12 months. So like I said, kinda bigger, ability to wear both behind each ear on the mastoid so we get those microphones in the right places.

Threshold's in the normal range with his Bahas. And after surgery, his hearing had worsened in one ear and his family pursued a surgical Baha on that side and then shortly after, surgically implanted on the other. So they're very thrilled with his process. We all know what happens when we get a kid fit and ready at three months of age. So age-appropriate speech and language and mainstream schools. He will just say that they give him the confidence and I like what his mom says that, he's always maximizing his hearing. So I have one more, real quick one. So unilateral case of microtia and atresia. So diagnosed with moderate conductive loss in right ear at three months of age. Got that three months down here. Fit with a Softband just prior to first birthday. We had a real delay with insurance in the beginning and I usually like to fit those kids a little bit earlier than a year, but that just didn't happen for her, insurance-wise, and then we made it happen. So here's her audiogram at 18 months. Using VRA, same as the other, same with Manny. And you can tell her speech lines up well as well. So kind of the same question. So what would you have done? Would you have been quick to fit that microtia kid on one side? What's she gonna do as she grows? Well, right now, she has a Softband since 12 months. Thresholds in the normal

range when we test that sound field with, I put masking in the good ear and test the other ear. It's just the way that I do things here. I don't plug, I typically mask and test the other ear and sound field with the processor. And so she only qualifies now for her deaf education services just because she is labeled as hearing impaired because of her hearing loss. She doesn't have any other therapies at this time. Her parents decided not to pursue any goals being that she's doing well with listening and spoken language. So the family is excited to meet with their surgeon pretty soon. She's getting to the age where they're gonna start looking at implantation and where to go from there. She's one of my favorite kids. So conclusions, real quick as we're heading through the last couple minutes.

Definitely feel that bone conduction is a very unique treatment solution for children, especially those with conductive, mixed, or unilateral losses. Cochlear offers a variety of solutions for these kids, and so it's really easy to find a way to get the right solution for the right child when you have a Softband or a SoundArc, Connect, Attract, and the three different levels of the Baha 5 Sound Processors and added the ability to use FM in schools. So those are our conclusions today, and we have like, oh, one minute for questions. I'm always happy to answer other questions offline. You notice there on the front that my position is Academy president right now. My email's on the website, if we don't flash it up here for you. I thank you all for your time today, and we will get everything you need, taken care of here for Softbands and SoundArcs and all of our processors.

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