

This unedited transcript of a continued webinar is provided in order to facilitate communication accessibility for the viewer and may not be a totally verbatim record of the proceedings. This transcript may contain errors. Copying or distributing this transcript without the express written consent of continued is strictly prohibited. For any questions, please contact customerservice@continued.com

Bone Conduction Hearing Devices:
Pediatric Considerations
Recorded May 26, 2021
Presenter: Laurie Mauro, AuD, CCC-A

- [Carissa] Hello, everyone, and welcome. My name is Carissa Moeggenberg, and I'm the training manager at Oticon Medical. It is my pleasure to introduce our guest presenter for today. Our topic for this month is Bone Conduction Hearing Device: Clinical and Surgical Considerations in Pediatrics. And I have the pleasure of introducing Dr. Laurie Mauro. Dr. Mauro is an audiologist at the Children's Hospital of Philadelphia. She received her master's degree from the University of Memphis and her AUD from Salus University. She has almost 20 years of clinical experience and has worked as a pediatric audiologist at CHOP since 2005. Dr. Mauro is a content expert in bone conduction hearing devices, with responsibilities including the development of evidence-based practice guidelines. She has presented regionally and nationally on the topic and is currently a member of the Pediatric Bone Conduction Working Group. We are very delighted to have her share her expertise in working with children with bone conduction devices. And on that note, I'll go ahead and turn it over to Dr. Mauro. Thank you.

- [Laurie] Hi. Thank you so much. So good afternoon. Again, my name is Laurie Mauro from Children's Hospital of Philadelphia. I was invited here today to discuss a clinical perspective and some considerations for surgical bone conduction hearing devices in pediatrics. Throughout today's presentation, I'll be referring to bone conduction hearing devices as BCHD. Just some housekeeping with some learning objectives, after this course, participants will be able to explain the nonsurgical and surgical audiologic candidacy criteria for bone conduction hearing devices. You'll be able to list specific features desired in a BCHD for children. You'll be able to recognize three surgical BCHD options and identify some fitting considerations for young children with SSD. So for today's agenda, we'll start with an introduction, discuss some candidacy criteria.

We'll go through BCHD evaluations and fittings, really with a focus on nonsurgical and surgical considerations, using several case studies. We'll finally have some

conclusions, and then we'll have some time for some question-and-answer at the end. So we're off to starting with an introduction. So as we all know, bone conduction hearing devices are known by many names: BAHA, bone-anchored hearing aid, bone conduction hearing implant, hearing apparatus. I'm sure I can go on and on. But really, the term bone conduction hearing device describes nonconventional amplification that's used for treatment of hearing loss through direct bone conduction. And this type of device can be nonsurgical or surgically implanted. And historically, a BCHD should be recommended to individuals who may be unable to use conventional air conduction amplification.

So today we'll take a look at all BCHDs, which are divided into several categories as seen here. So this image really breaks down all of the available options, whether they are surgical or nonsurgical. We'll be touching on almost all of these different BCHDs today. For a little bit of a background, really, to date, fitting protocols for BCHDs are not standardized, that often leave gaps in our clinical practice. At Children's Hospital of Philadelphia, or CHOP, really, like many institutions, use existing evidence as well as clinical experience to help develop practice guidelines. The information discussed today will include manufacturer recommendations, practice guidelines used by CHOP audiologists, clinical experience as well as data from the Pediatric Bone Conduction Working Group.

I always like to highlight this group whenever possible. This group consists of pediatric audiologists throughout the US and Canada, who have a special interest in bone conduction. This group was initially formed by Dr. Dave Gordey and Dr. Marlene Bagatto in around 2015 to collectively design and execute informative projects that are related to BCHD in children. We've already completed several projects over the years that looked at audiologists' BCHD selection and fitting practices. Ultimately, we really found that there were a lot of inconsistencies and lack of evidence-based protocols that were being used for, really, selection, for verification, as well as validation of

BCHDs for children. So all of these former projects really led us to complete a Clinical Consensus Document for Fitting Nonsurgical Transcutaneous Bone Conduction Hearing Devices for Children.

This has recently been submitted for publication and is in review with the "International Journal of Audiology." So we'll move right into a brief discussion on candidacy. So really, determining candidacy and evaluating a child for a BCHD really starts with an audiologic assessment by obtaining frequency-specific thresholds. This can be via ABR or with behavioral testing. As we all know, an ABR is recommended for children six months of age or younger, or for those who cannot complete behavioral testing. Both bone conduction and air conduction thresholds should be obtained whenever possible. And really, in order to fit a device, it's recommended that you obtain at least one low and one high frequency for bone conduction in that indicated ear.

Manufacturer criteria for fitting both ears with bilateral conductive or mixed hearing loss is that the bone conduction PTA really should be symmetrical and less than about 65 dB HL for some power devices. Again, manufacturer as well as most of the literature out there really determines candidacy by using a PTA for bone conduction thresholds of 500, 1,000, 2,000, and 3,000 hertz. However, in pediatrics, we don't primarily use 3,000 hertz. And 4,000 hertz really is a more clinically relevant frequency, since it can be maintained on ABR. And we think it adds more overall clinical value than 3,000 hertz. Some additional things to consider is that there really is limited evidence that supports fitting those mixed hearing losses that are in that 55 to... I'm sorry, 45- to 65-dB range.

We need to understand that the degree of that sensorineural component really may affect your device choice, as you would need to provide sufficient gain for that sensorineural component. And finally, the air-bone gap should be greater than 30 dB, as the greater the air-bone gap, the greater the perceived benefit. Candidacy for

unilateral conductive or mixed hearing loss is basically the same as with bilateral hearing loss. There are some additional things to consider, and that includes that the air conduction PTA in that indicated ear should be greater than 40 dB and less than 20 DB in that normal-hearing ear. And as previously discussed, the PTA air-bone gap should be greater than 30 dB, with actually the most benefit being perceived when that gap is greater or equal to 50 dB.

So onto SSD, so we know that SSD describes having a severe to profound sensorineural hearing loss in one ear, with normal hearing in the other. And really, up until just recently over this last year, CHOP did not recommend a BCHD for a child with SSD until they were school-aged or older and able to monitor their listening environment. The age was lowered to about six months developmental age when the baby is typically able to sit up independently with adequate head and neck control. This really ensures that you're able to maintain appropriate placement of the processor. And this is actually a really good recommendation for all unilateral hearing loss as well as binaural fittings. So now, we do not recommend a BCHD for every baby or child with SSD.

We do start with having a conversation with the family about what we know. So we know that to date, there really are no evidence or outcomes on BCHD use for infants and young children with SSD. Choosing to fit a device should be a collaborative decision between audiology, the ENT, and the family. We wanna make sure families understand that the BCHD will not provide binaural hearing. The main goal is to lift that head shadow effect by sending the signal from the bone conduction, sending the single via bone conduction, from that impaired side and routing to that normal-hearing ear. We can suspect that results can be expected to be similar to that of a CROS system, where many studies have shown that it may be beneficial and quiet, but may be more detrimental in noise, particularly when noise originates on that impaired side.

So I mentioned before, at CHOP, previously, we only recommended BCHDs for older children. However, we realized that BCHD technology continues to improve, and there have been significant advances in signal processing, adaptive directional microphones, and noise reduction, which can all be verified objectively using the Verifit Skull Simulator. We'll touch more on this later. If a parent chooses to have their baby or young child with SSD fit with a non-surgical device, it's really imperative that they be counseled on appropriate expectations and device usage. Specifically, the BCHD should be worn when the child's really being supervised and when there's not a significant amount of background noise. So we like to talk about some examples that include playtime with a parent or reading time or watching a show, playing a game on a tablet, eating meals at home, and one-on-one therapy services.

Examples of situation which potentially could be detrimental include noisy restaurants, crowded malls, sometimes a daycare, as well as maybe even a free-time at preschool. So really, as no evidence exists to guide the audiologist in the fitting of young children, the goal really is to ensure that no harm is done. What we're hoping is that, from careful monitoring of its use, we really hope that parents can provide us with situations where they found it appeared to be beneficial. So during a general BCHD evaluation, really, like any hearing aid evaluation, you start by discussing all types of amplification and remote microphones. This may include nonsurgical as well as surgical options, if it applies. Minimally, a BCHD should be trialed or demonstrated in the office by programming with custom in-situ measurements.

We're fortunate to have a bank of devices at CHOP that can be lent to patients for out-of-office trials so really that device can be worn at home and in school to determine benefit. Some of you may already take advantage of Oticon Medical's Pediatric Loaner Program, where they can obtain a loaner as well for out-of-office trials. During the evaluation process, you may perform aided testing, such as Ling 6, and recorded speech perception testing. So we'll start with a little bit about nonsurgical

devices. And back to the categories, primarily for non-surgical, we're talking about use on a soft headband, since it really is the best option for young children under five, who are not yet surgical candidates.

Here are some things to consider when fitting a BCHD on a soft headband. In terms of placement, many studies have shown that the best position is when it's placed right on the mastoid or, really, right above on that temporal bone, rather than being placed on the forehead. I often recommend primarily use manufacturer-made soft headbands over those homemade ones, since we know they provide sufficient and consistent tightness so that output is not variable. The soft headband really should fit snug so that it's secure in position but not so tight that you would not be able to fit one or two fingers in between the band and the head. And when considering fitting a baby with unilateral hearing loss or for bilateral fitting, adequate head control may be needed to ensure that you have appropriate placement of the processors so you're obtaining really the most benefit to that indicated cochlea.

I'm not suggesting at all that you should delay the fitting after diagnosis. I rather want to convey the importance of appropriate placement and acknowledge that really this is often difficult on a baby that cannot lift their head. In terms of important pediatric features, I really think every pediatric audiologist really has a wishlist of what features are important to consider. And these typically include, for bone conduction devices, an adjustable soft headband, really with the option to use a processor on one or both ears, a really good-tamper resistant battery door that meets industry standards. We need to be able to disable the volume control and programming button. And the device really must be durable, because we know that kids are very rough on anything that they own.

An indicator light is essential as it provides some information about how the processor is working, really without having to ask the child. So a parent or teacher can really tell

from across the room if the device is on and working, or if the battery's getting low, or if their microphone is connected, which brings me to remote microphones or other wireless accessories. Any device being considered for a child really should have an option for remote microphone for being used in the classroom. And then I really think, after this last year, with the world being introduced to virtual learning, having wireless connectivity to phones, tablets, and computers have become increasingly popular even for very young children. So let's look at what we would do in an evaluation.

So I would like to introduce you first to Beau. So when I first met him, he was 28 months and just adopted from China. He had a severe conductive hearing loss in both ears, secondary to atresia/microtia. His parents reported that he did not have any words, and he really did not appear to respond to any sounds. So even though he was only on my schedule for a regular hearing test, I actually fit him that day with one of our CHOP loaner devices, which was actually a Ponto Pro on a soft headband. My coworkers really can attest that I often do these BCHD fittings on the fly, especially when a child does not have access to sound.

But we ended up scheduling him for a full hearing aid evaluation about three weeks later so we can discuss all the different devices and features. So during that evaluation, the BCHD options were between a Cochlear Baha 5 or Oticon Medical Ponto 3. We ultimately decided to proceed with bilateral Cochlear Baha 5's with a Mini Microphone 2+. So Baha was recommended over the Ponto at that time since I wanted Beau to have access to a remote microphone, and the Ponto 3 required him to wear a streamer, which was not an ideal situation for a two-year-old. So back to the evaluation, so with Beau, we discussed all amplification and remote microphone options. We were only focusing on nonsurgical, since he was only two.

And he was already successfully using a loaner device, which leads me to programming the processor by completing custom in-situ audiometry thresholds within

the manufacturer software. So these measurements can be completed in the hearing aid or programming room using your Noahlink Hi-Pro, I mean your Noah Hi-Pro, or a Noahlink Wireless. In that first top picture, I'm actually sitting at the computer presenting the stimulus while I had one of my colleagues behind me, sitting at that small table with Beau. I don't know if you can see, there's a tiny little black box just to the left, and that's actually a portable VRA puppet that I brought into the room. We were using both VRA and CPA to try to obtain those in-situ thresholds.

For use in the sound booth, you can either use Noahlink Wireless or patch Hi-Pro cables through the wall panel. I actually do prefer to complete these measurements in the booth, which allows you to do VRA, CPA, or voluntary in a quiet environment. That bottom picture really shows how we installed the manufacturer software on the computer. The Noahlink Wireless is placed on the tester side, and it actually transmits beautifully to the patient's processor through the other side of the booth. So what we also discussed during the evaluation is, you know, as a child gets older, different features may be warranted. Often, new processes are released. For Beau, we chose the device that was most appropriate for his needs at that time.

I really made sure that the family understood that decisions we made at that time did not commit him to a single manufacturer throughout his lifetime. So for Beau, about two years later, when he was four, he was actually eligible for an upgrade. So there were some speech concerns. So really, we wanted to take a look at power processor options as we really found that the higher MFO is really a better option for the softband. The family was reporting that he was really not consistently using the Mini Microphone. So our current options were between the Baha 5 Power and the Ponto 3 P/SP. Really, all of our boxes for important features were checked for either device. But ultimately, we selected binaural Ponto 3 SPs.

And since he was already four, we started to discuss surgical options, which leads us to the very next section, during a surgical BCHD evaluation. First, as part of the evaluation, I really make a point of discussing that an exact demonstration of a surgical BCHD does not exist. There are many differences in the output of the device on a soft headband compared to what it would be in a surgical system. But we do know that benefit with the device on a soft headband can give some indication of expected performance, which is why we also really encourage our patients and families to complete out-of-office trials for anyone that is considering surgery. Now, I've worked with many families over the years who may not be interested in pursuing any surgical options.

Their child may be doing really well with their soft headband, and they may not think there'd be really any additional benefits of surgery. So I like to review that there are many studies that have shown that there's improved hearing with that surgical system over that nonsurgical connection. And these improvements include improvement in aided thresholds overall in speech perception testing. Patients report better sound quality and performance. Some studies have shown that there's an increase in learning speed and enhancing working memory. And we really believe that all of these benefits are a result of that high-frequency emphasis that is achieved with that direct surgical transmission, really, over that nonsurgical connection, since we know that those high frequencies are often weakened as they pass through the skin.

Specifically, for SSD, the goal is to provide more high frequencies to really lift that head shadow effect, which is above 1,500 hertz. So studies have shown that direct-drive percutaneous surgical systems can have better results compared to the softband systems. So again, this information, I like to discuss, especially for those patients that may be on the fence after they've completed an out-of-office trial. All right, so getting back to Beau, so he's five. So we were discussing surgical options, which, at that time, because of his age, we were deciding between a percutaneous system and a passive

transcutaneous system. So percutaneous options included Cochlear Connect or Oticon Medical Ponto. For transcutaneous, we were primarily discussing a Cochlear Baha Attract.

So in the US, really any child who's five or older without any medical contraindications can be considered a surgical candidate. And this really includes conductive, mixed, or SSD. In my experience, a percutaneous system really provides the best outcomes for some of those mixed hearing losses, even if manufacturer criteria may suggest otherwise. Some additional criteria includes that there must be really sufficient skull thickness and temporal bone quality, which are typically addressed by the ENT surgeon. We make sure the family understands and is able to maintain and clean the abutment site. And we wanna be cautious about recommending percutaneous systems for a child with significant developmental delay or behavior problems that may jeopardize or harm that surgical site.

For abutments, I also discuss, it's likely at some point there will be a need for at least one revision. Really, the most common issue with abutments is inflammation or soft tissue regrowth around or over that abutment. Poor or excessive hygiene is the most common cause. However, it is more prevalent in male teenagers. That often results in the need for surgical intervention. ENT may recommend cleaning of the site a different way or certain steroid creams, oral antibiotic, a steroid injection and/or a surgical procedure, which would either revise the skin around the abutment and even or maybe place a longer abutment. So for Beau, we also talked about Baha Attract. And the main advantage was that there's no abutment.

It is more cosmetically appealing. There's no concerns regarding infection or cleaning. It was easy to connect. And if at some point something changed, it's easy to convert to a digital abutment later on. But for disadvantages, really the main part is that an abutment results in better hearing. And we really find that the magnet and processor

are not secure, and retention really is a huge issue, which is why I rarely recommend Attract for patients with bilateral hearing loss, because they really are relying on the use of their processors at all times. Okay, so Beau's surgical outcome, so the advantages and disadvantages of both systems were discussed. They were not overly concerned about cosmetics, and they really wanted the best hearing outcome.

So ultimately, we decided on a bilateral simultaneous Ponto percutaneous system with a two-stage procedure. Beau's first stage was to place the Ponto implant, and which was completed at around five years of age. And then the second stage took place, the Ponto abutment was completed about five months. Beau was fitted with bilateral Ponto 4 processors with an Oticon Medical Connect Clip remote microphone. So with patients, we discuss that the processor fitting cannot take place until that soft tissue is healed, and they are medically cleared by ENT. In some cases, it may be beneficial to wait until that bone conduction implant is fully osseointegrated. And really, percutaneous fittings really should be verified to DSL bone conduction targets using the Audioscan Verifit Skull Simulator.

So there are many capabilities of the Skull Simulator. You can complete an ANSI check and compare the device over time. As of right now, I believe there still are no current specs for the Skull Simulator. For percutaneous fittings, there are DSL bone conduction targets for children and adults, which objectively verify the fittings, which promotes consistent and beneficial levels of audibility. You know, I really do hope that targets for nonsurgical BCHDs are coming soon. But for softband patients, you can still verify those advanced features such as noise reduction and directionality. You can calculate the aided SSI values. You can verify remote microphones and assess how the feedback manager affects the frequency response. So really, for more details on verification, please view the works of Susan Scollie and Bill Hodgetts.

I included some of their fantastic AudiologyOnline presentations and papers here, because I really am unable to do them justice. I would need to at least another two hours. So back to Beau, I used the Skull Simulator to verify his Ponto 4 fittings to DSL bone conduction targets. In terms of follow-up visits, at CHOP, we really recommend that that first follow-up appointment be scheduled about one month post fitting, then every three months for the first year, every three to six months for that second year, every 6 to 12 months thereafter. And we know that additional visits absolutely may be needed if concerns arise and/or if limited information is obtained during a single visit. We recommend that at least one validation tool be selected for use during each appointment, as deemed appropriate based on the patient's age, ability, and developmental level.

Validation tools are divided into three categories: access to information, such as data logging, which we use all the time, aided speech perception testing, as well as outcome measures. And really, whenever possible, we recommend that both aided speech perception and outcome measurements really be assessed, really to cross-compare and obtain the most comprehensive information possible. So here are some examples of common outcome measures. So the LittleEars questionnaire is recommended for use with children birth to about two years of age, the PEACH for children three years of age through school age, and really, the SIFTER gives really good information about how a child may be performing in school. All right, so back to Beau, so about six weeks after his first fitting, the family started to report some redness and irritation around that right abutment.

ENT was contacted, and he was treated with an oral antibiotic. And they recommended changing his cleaning a little bit and using kind of a soft toothbrush. Two weeks later, I actually received a call from the parents reporting that the abutment fell off. It was actually a complete implant failure. So while they were removing his processor, the entire implant and abutment became dislodged. There were no reports of trauma at all

to that side. Surgery was recommended right away, really to place the implant and the abutment as a second implant, what we call a sleeper implant, was not placed since he had a binaural procedure. Beau was really hesitant right away to proceed with another surgery. And even though I recommended him resume using his softband, he refused at that point.

I wanna point out that I really think implant failures are extremely rare. I've really only ever seen one or two in my career. So at every followup appointment, I continued to recommend that Beau use both processors. But really, only recently he finally agreed to try both devices in the clinic. I was able to do some aided testing, which required Beau to use his device really long and for five minutes. The aided testing really was showing good benefit. My Ling 6s were all at 20 dB. He got 100% on the PBK. And he finally admitted, wow, I hear better with both. I was like, thank you. See, I knew you know what I was talking about. So here are my final thoughts on Beau.

So right away, I reprogrammed his Ponto to use on a soft headband immediately, really, as I would do with any patient who may be having some issues with their abutment. But it really took some time and convincing for Beau to agree to use it. Beau has a pretty significant speech delay, so I really wanted him to use both devices, especially over this last year, you know, given the state of social distancing and use a face masks, since we really know that causes more hearing difficulty. You know, a couple of weeks later, the parents did report that there was improvement in Beau's responses and attention. And he also admits to his parents that he hears better using both his Ponto on the abutment and his Ponto on the softband.

We revisited surgical options several times over the last year, but he's really not ready to proceed with doing anything, but was interested in asking me some things about the active transcutaneous devices. He knows that he's not a candidate yet, and he's not ready to do anything. And he loves his Ponto so much. He would only consider that

for that right ear should Oticon Medical release one that is compatible with his current Ponto. Hint, hint, anyone from Oticon Medical, okay. So we're gonna move on. And I would like to introduce you to Grace. So Grace has hemifacial microsomia with a moderately severe conductive hearing loss in the right ear, secondary to atresia/microtia. She has a normal-appearing left ear, which actually has an absent cochlear nerve, which we found later on.

Grace was first fit with the BCHD on a soft headband right before around two months of age. For many years, Cochlear was really the only option that was available with her medical assistance insurance plan. So really, a full evaluation was not required. So over the next couple of years, Grace she has many different processors. She had an Intenso, a BP110, and then more recently a Baha 5 Power. Her aided Ling 6 thresholds with the Baha 5 Power were really as expected with a soft headband, really good for most of them but slightly elevated for those higher-frequency sounds, SNSH. She got 100% on the aided NU-CHIPS, which was presented at a 60-dBA presentation level. And her PEACH outcome measure really revealed typical performance in all of her listening conditions.

So around age four or five, we started discussing surgical options. You know, remember, Grace only has one cochlea. So they really were not considering Cochlear Attract at all, because they knew that percutaneous results in better hearing. So the percutaneous options were between Cochlear Baha and Oticon Medical Ponto. Grace actually asked to trial a Ponto at home before making a surgical decision. And she actually preferred the Ponto 3 SP over her existing Baha 5 Power. So she moved forward with scheduling an Oticon Medical Ponto procedure with the BHX implant, which was a two-stage procedure, which also included a sleeper implant, since she was implanted unilaterally. She was fit with Ponto 3 SPs about five weeks following her second stage to place her abutment.

So at the time of her surgery, the Ponto 4s were not yet available. But Oticon Medical did release a technology upgrade program, which allowed her Ponto 3s to be upgraded for free when the Ponto 4 was released. So here are Grace's verification using the Skull Simulator to DSL bone conduction targets as well some of her aided testing, which showed really good benefit. So let's share some final thoughts on Grace. Number one, you know, a normal-appearing ear does not equal normal hearing, just as atresia does not always equal conductive hearing loss. So I think it's really important that you obtain results on each ear whenever possible. You know, Grace can never have binaural hearing. And really, there's no way to route sounds from her left side.

So I do wonder if there ever could be an option to create a bi-cross for a BCHD. You know, Grace really played an integral part of the surgical decision process. She did not decide to just go with Cochlear just because she had a Cochlear device. And really, it was difficult for her to notice any differences between both the Baja and the Ponto in the clinic. So really, being able to trial that device at home and in school really did help her be able to make a decision. Okay, so my last case study is Bianca. So Bianca has Treacher Collins syndrome. She has bilateral microtia with a moderate conductive hearing loss in both ears. Bianca actually was able to wear an air conduction aid in her left ear and use a Cochlear Baha soft headband on the right ear.

Like Beau, at around five, benefits of surgical BCHD was discussed. At that time, percutaneous was really the only option available. Attract, I believe, was released about a year or two later. But Bianca did not want to have surgery. She continued using both her hearing aid and her Baha for several years. Bianca was actually my very first bimodal bone conduction patient. So many years later, when Bianca was around nine, she was using a Baha 4 at that time, and she reported, really, she was only using it in school and really did not want to use the softband anymore, which led me to, again, revisit surgical options. She did not want to have an abutment. So really, the advantages but more the disadvantages of Baja Attract were discussed.

So we knew that Bianca used her air conduction hearing aid during all waking hours. And she was obtaining good aided benefit with her Baja 4 and the softband. So ultimately, we agreed to pursue a Cochlear Baha Attract for the right ear so she did not have to use the softband anymore. And then as Bianca returned for visits over the next few years, she reported retention issues with the Baha Attract, really just as predicted. I reminded the family that it was really due to the weight of the processor, and it really was expected to fall off with excessive movement. And I reassured her that the magnet strength was appropriate, and using a stronger magnet would yield the same outcome and really not make that processor more secure.

So now, at age 12, we revisited some additional surgical options. She still would not consider a conversion to a percutaneous system. But now, with her being 12, we were able to discuss the new active transcutaneous BCHD options, which, for those active transcutaneous devices, we're primarily talking about MED-EL BONEBRIDGE and Cochlear Osia. Both are approved for children 12 years of age and older, for those that have conductive mixed hearing loss as well as SSD. So for Bianca, with her conductive hearing loss, criteria was basically the same for both devices. Although, Cochlear does report that the Osia is a little bit stronger than BONEBRIDGE with a bone conduction PTA of 55 dB or better. For Bianca, we really were taking a deeper dive into the available processors.

So we were looking at the Osia 2 and the SAMBA. You know, Osia offered wireless accessories and connectivity. It had a remote microphone as well as a smartphone app. At that point, the SAMBA 1 was the one that was available, and it did not have wireless connectivity or a smartphone app. And in order to use any Bluetooth or remote microphone connectivity, it required a Siemens miniTek. At some point during a surgical evaluation, you should discuss MRI compatibility should that ever be needed. So for percutaneous systems, both the implant and abutment are MRI conditional up to

3.0 T. So really, if there's any indication that a child may need frequent MRIs, we may not recommend a system that utilizes a magnet.

But I do reassure the family. It's hard to predict at five or 12 if that's ever needed. And so we discuss that if the MRI is needed, and they have a magnet, that magnet can be removed but will require a short surgical procedure. So for Bianca, for her surgical decision, so both Cochlear Osia and MED-EL BONEBRIDGE systems were discussed. But really, at that point, the technology features and connectivity that was available with the Osia 2 processor was really more favorable than the SAMBA. We know now, there is... The SAMBA 2 was released, which does have remote, a remote app, sorry, wireless streaming and connectivity, but it does require the patient to wear a SAMBA 2 GO streamer. She decided to proceed with Cochlear Osia conversion.

And so that Attract magnet was removed, and the new Osia implant was placed during a single procedure. And so, I mean, here are my final thoughts on Bianca. You know, her current technology, she used a Cochlear Osia 2 on her right ear. And at this point, she had a ReSound LiNX 3D 77 air conduction hearing aid for the left ear. She was able to use the Mini Mic 2+, which actually does transmit to both devices. So she was able to use that in school. But we found that she's unable to stream from her phone or pair any wireless accessories to both devices simultaneously. So we really started to think, well, should we be considering Osia for her left ear as well?

But is air conduction still preferred? And do you always recommend air conduction wherever possible? But does being able to have binaural streaming really trump everything else? I mean, these are all questions that we're discussing and currently working with together. Okay, so to summarize, for a surgical BCHD evaluation, really, if you're starting when a child is under five, you're gonna just only start talking about nonsurgical options and really just reinforce that any decisions that they make for a device really should meet their current needs. Surgical options can be discussed

gradually, really, during follow-up appointments as they come back. And really, as of right now, those surgical options are really driven by age as well as maybe the type and degree of hearing loss.

You know, about a year ago, I saw a 12-year-old with unilateral conductive hearing loss. He had atresia. And he is now interested in amplification. So I really learned the hard way that you should not discuss all of the nonsurgical and surgical options in a single visit. It was so overwhelming, and I ended up spending about three hours with them. And I really think it was so overwhelming, and the family left with probably more questions than answers. And I did need him to come back for a few visits after that. So I now recommend that in that initial appointment, you may wanna discuss nonsurgical options, and maybe even have the child complete an out-of-office trial to determine benefit.

And then maybe as they come back for follow-up visits, that's when you can focus on surgical options. And finally, I recommend that the child really proceed with the current surgical option that's available for that age. I think a lot of patients and parents are really now interested in active transcutaneous devices, but maybe their child's only five or six. You know, I'm often asked, really, should they just continue to use their softband until they're 12? And I really think it is a personal decision. But for some families, the benefits of going through with the surgery now that's available for their child, so the benefits of that surgical transmission really may outweigh the concerns of their child going through another surgery when they're 12, which could be five to seven years.

I think it's been comforting that I'm able to discuss with our patients that about half of our current patients who have been implanted with active transcutaneous devices were successful abutment conversions. And so really, the decision to proceed with the surgery now does not exclude them from another option as their child gets older. And before we wrap up, I really wanna take a second to highlight these counseling

booklets, which were created in collaboration between myself and Oticon Medical. So they're currently in production, and I believe they'll be available soon. This first booklet, "Navigating Your Child's Hearing Future with a Bone Conduction Hearing System" is primarily a counseling guide that's geared specifically to children who may use a bone conduction hearing device.

It covers understanding their hearing loss. It explains different audiologic tests, recommendation, and referrals to additional providers, as well as the importance of establishing therapy services. What makes this guide unique is it focuses on how a BCHD may differ from traditional air conduction hearing aids and includes really everything I think that you as the audiologist would want the family to know about their hearing loss and their Ponto device. The second booklet, "Moving from the Softband to a Ponto Implant," is a parent's guide that offers information and answers to really common questions and concerns as their child starts to make that transition from their softband to a surgical bone conduction implant. You know, I know many of these counseling guides already exist for air conduction hearing aids.

And I'm sure you can agree that having something specific like this to bone conduction devices will really be a valuable resource. Okay, thank you so much for joining me today. And thank you, Oticon Medical, for inviting me. I hope this information I presented today was exactly what you were looking for. So I am now available to answer any questions.

- [Carissa] We do have a few questions. I believe you have addressed them, but if you wouldn't mind just reiterating kind of your response to these specific questions. The first one is, what's the earliest age you feel a child could be a candidate for a surgical option?

- [Laurie] So in the US, and it differs in other countries, it is five years of age and older, so without any medical contraindications. So I did talk about that a little bit on some of those slides. So as of right now, for both percutaneous systems, abutments for both Cochlear and Oticon Medical, and transcutaneous systems for Attract start at five. For the active transcutaneous systems, so MED-EL BONEBRIDGE and Cochlear Osia, those, as of right now, are 12 and older.

- [Carissa] Perfect. Thanks. And then the next question comes based on the recipient Bianca, the little girl that you talked about. They wanna know why fit Bianca bimodal instead of bilateral with bilateral BCHDs, which you did discuss, but I don't know if you wanna elaborate a little bit more, maybe reiterate on why your decision.

- [Laurie] Yep, so I really would have loved another entire hour, where I could have gone into more details about Bianca's history. I did do a presentation last June that is available on AudiologyOnline, that talks about Bianca's transition from when she was an infant and when I first started fitting her with a bone conduction device and an air conduction hearing aid. She was always able to... Her ear was able to maintain an air conduction hearing aid in that one ear but could not hold one on the other. So she always, I think, since she was about two or three, used an air conduction aid on one side and then a softband on the other. And then, I think, you know, she was so hesitant to any surgery for many, many years, even though I've always discussed with her and the family about how much better you'll hear with a surgical procedure, all of those things that we talked about previously, it took really some time, and they wanted Bianca to make the decision.

And it was really, she made that decision when she was nine. And so we thought, you know, with ReSound hearing aids are compatible with Cochlear, except you're unable to stream or use the remote app with both devices simultaneously. She could switch back and forth, which, even though she loves her hearing aid and is doing so well, we

started discussing the Osia in both ears. And she is doing really well with her Osia. So it is something that she is considering.

- [Carissa] Great. Thank you. And then another question that came in is, can you talk more about the timeline and considerations of moving forward with a bone conduction softband for infants diagnosed with SSD?

- [Laurie] So again, if you've heard me talk, up until today, our recommendations were really not to fit young children for all of those things that I talked about as some considerations. I think what led us to revisit things over this last year was, I did start looking at some of the more advanced features, which makes me be a little less concerned about an infant wearing it or a young child who can't give us some information. So as well as with cochlear implant being an option for some children with normal nerve and normal anatomy, some insurances do require some other technology option, okay, which, here at CHOP, we do do a bone conduction device on a softband as a trial for those considering cochlear implants, as well as air conduction hearing aids.

We know that a bone conduction device will not provide any benefit to that cochlea but at least shows potentially how the parents at least tried other technology before jumping right to a cochlear implant. You know, to be honest, a lot of my families, where I go over what we know about the evidence and what our concerns are about introducing noise into that ear, are not choosing to proceed with an infant with wearing a device. The reason we chose six months is, again, because they're able to sit up, and you can position it in the appropriate location. And I do have some families now. I have a one-year-old and a two-year-old that is actually trialing a bone conduction device for SSD, and both the families and their therapists and teachers, their preschool teachers, really have good understanding of when they want the child to wear it, and when they wanna take it off.

And I think, you know, 10 years ago, we did some trials with older children, who can report about how they were hearing with their devices. And they told us that sometimes it helped, using it, and then sometimes when they were in noisier environments, they ended up taking it off. And so these are all things that I talk about during the evaluation.

- [Carissa] Great. Thanks. That was the last of the questions. So I think, if there aren't any more questions, we are all set to end today's session. I wanna thank you all for your participation. I look forward to attending a future Oticon Medical event. And I wanna especially thank Dr. Mauro for all of her expertise and being so willing to share what she's seen over the last 15 years with bone conduction hearing devices. So thank you.

- [Laurie] Thanks so much, and my contact information is right on this last side. It'll be in your handout. So if there are any questions, feel free to contact me.