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Pediatric Balance Assessment: It's as Simple as A-B-C, in partnership with the American Academy of Audiology

Presenter: Richard E. Gans, PhD, CCC-A, DFAA

At this time, it's my pleasure to introduce our presenter, Dr. Richard Ganz. Dr. Ganz, as you know, is a renowned researcher clinician in vestibular and I invite you to our course page to read more about his bio. He has served as the American Academy of Audiology Board of Directors for six years as PAC Chair, Treasurer and President. He was awarded the Academy's Distinguished Achievement Award and is a Legacy Distinguished Faculty Fellow. He's a life member of ASHA, a research scientist, member of the American Academy of Otolaryngology and the American Academy of Neurology.

I am honored that he is with us today to kick off our webinars on Audiology Online for 2026. Dr. Ganz, I'll turn it over to you. Thank you very much, Carolyn. Hey, Happy New Year everyone. Unfortunately, I've got a little New Year's laryngitis, so as Carolyn suggested, you may want to put on the cap.

It's my pleasure to introduce a message from President Gaffney. Tish was actually my AUD doctoral student at University of Pittsburgh a number of years ago. I'm very, very honored and proud of her many accomplishments. So here's a message from Dr. Gaffney. Welcome.

I'm Tish Gaffney, the President of the American Academy of Audiology and I'm here to share important information about the organization. The Academy is dedicated to achieving recognition of audiologists as the experts in hearing and balance care and the field of audiology as an independent clinical specialty that is integral to the healthcare team. Through our partnership with Audiology Online, we're excited to offer courses like this one to help you broaden your knowledge and skills. We also offer the latest resources in practice management and evidence based clinical practice so you can grow professionally and improve patient care. We advocate for our members in Washington and across the country to ensure that the voices of audiologists are heard and we help connect audiologists to one another through our valuable networking opportunities like our annual convention.

To learn more about the Academy, make sure to visit audiology.org thank you.

Just to let you know, I don't have any financial disclosures so we can go forward with that.

Limitations and risks. You can read this for yourself. I kiddingly say don't drop the babies. That's the big risk. So make sure you're handling your babies with dry hands.

Just kidding. Nobody's going to drop a baby. Learning outcomes. You can read these for yourself. I think we're going to present everything in a very straightforward method for you.

One of the questions people ask is, hey, I don't see dizzy babies, I don't see dizzy children. How do you see all of these kids? Simple. For 36 years, we have not charged any family that does not have insurance. And we've been doing all the work for Johns Hopkins, all children's hospital here in the Tampa Bay area.

So when you don't have any financial. Financial obstacles, it's amazing who shows up at your clinic. So that's one of the reasons we probably have one of the largest databases of infants and children with and without hearing loss, maybe in the country. So let's first start a little bit about the development of the peripheral and central vestibular system.

First of all, let's agree that the primary function of the inner ear, sorry, cochlea, but it's not hearing. The primary function of the inner ear is balance. And this is referred to as a phylogeny of a species. Think about it. Could a species survive, hard of hearing or deaf?

Of course, obviously, we've had individuals that have been deaf since the beginning of time, prior to the advent of cochlear implants. And there was no challenge to survival. But imagine if you couldn't detect gravity, if you couldn't navigate through space, you would be helpless. So obviously it is very, very important to the survival of the species. More importantly, this system is fully developed by 49 Days in Utero.

That's right. By seven weeks, the peripheral vestibular system is full adult size. Quite amazing, isn't it?

Now, obviously, when a baby's born, they don't jump out and have full normal balance function. It's going to take weeks, months and even years for all of the systems to become developed and to myelinate properly, especially the vestibular ocular reflex. Any of you moms and dads in the audience, what you probably notice is none of you had a baby, an infant, a neonate that was car sick, because the VOR doesn't mature to the point of developing car sickness and having vestibular, vestibular interaction difficulties till about two to three years of age. So it's really surprising, isn't it? You think, my gosh, this is weird.

You know, little Joni never got car sick. Why is it now she's getting car sick? It's because of the development of the vor.

Now we know that equilibrium is sometimes referred to as the sixth sense. It is a very sophisticated integration of the vestibular system, which is internal. It's our gyroscope and vision and somatosensory which tells the brain about the external world. So the central nervous system is constantly sending signals to the brain, am I moving or is the world moving? If I'm moving, I have to make adaptations so I don't fall over.

Likewise, if the world is moving, I have to adjust to that as well.

So although fully anatomically adult at birth, it's going to take years. And that's why we have maturational norms. And these maturational norms are going to be indicators if a child potentially has a malfunction in peripheral or central vestibular function. Now remember, before our dear friend, the great Marion Downs pushed early childhood hearing testing, what were the earliest indications of of a child having hearing loss? Right.

Delayed speech and language. Well, guess what? If a child has delayed or inappropriate maturation milestones for balance control, movement, coordination, orange or red flag, we may have abnormal vestibular input. So what are some of the causes?

We have five major categories. Migraine, otitis media, trauma, congenital and syndromes and non syndromes.

So who are at risk? First of all, infants and children identified with unilateral or bilateral sensorineural hearing loss. There are over 500 heritable syndromes, mitochondrial disorders that have vestibular expressivity. BPV of Infancy, one of the earliest indicators of childhood, migraine. We can have a torticollis.

This can be at birth or it could be acquired. Again, clumsy, discoordinated children or any child that has dizziness, unsteadiness or balance difficulties after even mild head trauma. These should all be red flags of a child that should be further evaluated.

As I mentioned, lots of different genetic conditions, inheritable conditions. However, Interestingly, of the 500, the majority do not also have concomitant hearing loss. Now you may recall from your genetics class that Wartenberg has greater vestibular expressivity than hearing loss. So just because child passes hearing screening or does not present with hearing loss does not make them immune from having a heritable vestibular involvement. And here is an overview of all the different syndromes that are known to have vestibular expressivity.

So you can cut this out and put it up on your refrigerator.

Now, the earliest form of migraine is BPV of childhood. Now please don't get BPV of childhood. Benign proximal vertigo of childhood. Confused with bppv, which is what? Displacement of oticonia within the utricle.

It is completely different, but this is the leading cause of pediatric dizziness and it usually occurs between the ages of 1 to 4. Now it's a diagnosis of exclusion. There's no test for this, but usually mom or dad are migraineurs.

The good news is that they will outgrow this. The bad news is 30 to 50% of them when they reach puberty will turn into full blown migraineurs. Also remember, according to the American Academy of neurology that 50% of migraineurs don't even recognize themselves as being migraine. So what are the symptoms? The child is normal playing and then all of a sudden looks like they're drunk.

They may have a ipsilateral contraction of their sternocleidomastoid muscle. They may or may not have this torticollis. The torticollis will not recover after this short episode of vertigo appears. Many parents come in now with recordings on their SmartPH of nystagmus. Watch the nystagmus.

It does not behave like bppv, which is what? Gravitationally driven. Because this is a neurological derivative, the nystagmus could be upbeat, downbeat, horizontal, rotary, torsional. So don't expect it to follow patterns of classic gravitational BPPV with the involved undermost ear.

We also have puberty onset. This is very, very common, more pronounced in female, because remember one out of four females is genetically disposed to migraine. One in six males, hearing loss and tinnitus does exist, but it is rare compared to vertigo. We now know that vestibular migraine. In fact, I just did a post today on LinkedIn and Facebook about prophylactic treatment for vestibular migraine is the number one cause of non otologic vertigo.

So what do migraineurs often have? They often have hypersensitivity to motion. They have misophonia, which is hypersensitivity or dislike of loud sound, photophobia, dislike of bright light. So many of these young girls also I just did an article, in fact it was in, I think the January, December, January Hearing Review on pots, right? Which is tachycardia that is seen in young adolescent females.

So there's a comorbidity higher than chance alone between vestibular migraine, puberty onset and pots. So if you have young females, especially if they're coming into puberty, these should be cautionary indicators that you're looking for.

Also concussion, concussion is a diagnosis of exclusion. Believe it or not, the number one concussed individual is a female adolescent soccer player. Not because of headers, but because of head to head, head to elbow, head to goal post. And what we even know is if a adolescent female or any female is concussed during their menses cycle, their Symptoms will be more severe and will be more prolonged. So we have some comorbidities here that we have to look at.

So be aware always of mild head trauma. They don't have to have a diagnosis of concussion. Remember, concussion is a diagnosis of exclusion. But here are many of the indicators that you may see at bedside or in clinic.

Labyrinthine concussion. Think about the membranous labyrinth. It mimics the cortex. It's soft tissue surrounded by fluid encased in bone. So you can have even a non direct, more of a whiplash type of head movement where the membranous labyrinth slams into the bony labyrinth and you can get some soft tissue damage resulting in some symptoms, concussion like symptoms, confusion, difficulty reading, difficulty with balance that are not related specifically to a direct head trauma.

So let's look at some behavioral assessment tools.

First of all, we have three modalities to evaluate the vor, the VSR and the vcr. So with the child we want to test all three. How are we going to do this? Well, for the vsr we're going to look at motor milestones. For the vor, we can look at the presence or absence of nystagmus, conjugate eye movement, optokinetic reflex.

And for the vcr we can look at the cervical vemp, which we can test in young as 3 months of age.

So here's a list of maturational motor milestones. Learn these or cut them out and again put them on your refrigerator. Right. When should we be concerned if a child is, I would say three months or longer late in any of these orange flag. So learn these, talk to mom and dad about them and you're going to do a lot of observation which you'll see in the upcoming videos.

Here are some age based protocols that you can use. But you can see you can begin testing or looking at infants as young as 3 months of age because this is when the neck musculature is usually mature enough so that the child is no longer a kind of a bobblehead.

Right. So before I start the videos, let's look at some of the things we're going to look for. So we're going to look at neck writing, we're going to look at body writing, we're going to look at the presence of a Landau reflex. And again we're going to look at this within age norms.

So is the postural tone abnormal? Right. Is it abnormal ipsilateral or bilateral? And I'm going to show you videos of normal kids. Then I'll show you some Abnormal kids.

So we don't need big expensive equipment. We're going to use some physio balls. Here you see the child is in a prone position. He's not posing. I'm also going to destabilize him on the physio ball to see if the head and torso can stay stabilized over his pelvis.

Again, I'm going to use mom here. And if you notice, you'll see in this picture the baby is lifting his head up. That's your gravity sensor. Pull up, Pull up. So let's look at this little girl.

She's recovering from a torticollis. And kids with normal vestibular systems love doing this because they can play and have fun.

And if you see she's very stable, you're only going to do 30 or 40 seconds per game with them. Here I'm looking at limits of stability. She's too small to put on a CDP system. So you'll see she has a normal ankle strategy. She's able to do it with her eyes closed, so she's not visually preferenced.

Here's a cute little girl Again, we're going to push them on their limits of stability.

Now, I'm not just playing with her, I'm actually making her reach outside of her limits of stability. But what you'll see here is children with intact vestibular systems love to play. They love to be lifted and moved.

Here's another little girl.

These are all children with normal hearing, but that have torticollis secondary to BPV of infancy. Now here I'm going to. You see, she's getting ready to stand. Her feet are hitting the ground solidly. She's doing a great job there.

Here I'm going to look for a Landau reflex. Look at her legs kick up. There they go. There's the Landau reflex.

There's the leg kicking up again. Here she is on the physio. Notice that she places herself in that prone position. That's the gravity sensors working.

Now, what do you think about this baby? This baby is the same exact age as the one you just saw. Does this look normal? Absolutely not. This is a baby with Charge syndrome.

So you have a bilateral dysfunction.

What you'll notice here is she doesn't want to be on the physio ball. She wants to be on Mother Earth. Now, when you watch the course yourself, these videos will run much longer. But I've got to move along here. Now here's a program I did.

This little girl is pre activation for a CI. This is a four and A half year old girl. Look how limp she looks. See the loss of postural tone bilaterally? Grossly abnormal.

See how limp she is?

She doesn't want to be on the trampoline. She'd rather crawl on the ground. Grossly abnormal. So now let's look at some other tools that you can use. Don't try to do VNGs on infants and very young children.

You have many, many other tools to use. So this idea that you've got to wait till a child is four or five years old to do a VNG is ridiculous. That's just not true. If you don't know how to do it, refer to somebody who does.

Here are the normative data for cervical vemp. We've tested hundreds and hundreds of infants with cervical vemp. It's easier to perform vemps on infants than on old people. And here's the normative data. Right?

Here's an article from Richard Roberts and I. But I'm not going to get into this. I want to get to the videos. Very easy to perform. Let's actually look at.

It's easy to find the sternocleidomastoid muscle. You always have mom participate. They're very, very easy to test. Look how happy and easy the baby is. You just have to make sure that tympan reflex is present and there's no middle ear effusion or conductive loss.

Very, very easy. Also the video head impulse test is very, very easy to do with infants as young as 10 months.

And you can see these are the results on a 10 month old. We have no catch up saccads and we have bilaterally normal horizontal head impulses. Okay, here's a little puberty onset young lady. We're doing the V hit with her.

She has, as you can see, abnormal vhit on the right.

And normal vemp. So what do we know about that? We know that the superior portion of the nerve is not affected, but the inferior portion was affected because the abnormal vemp. That's why you want to do multiple tests to better differentiate. Do I have superior nerve involvement?

Inferior nerve involvement are complete.

All right, let's do a couple of case studies quickly in the few minutes we have left.

Here's one of my favorites. This was a young man with spinal bifida that was confined to a wheelchair. He had horizontal canal bppv. We treated him very easily with Kasani and Apiani treatments.

With great results. Here's another one. This is. You're going to find this very interesting. This is a 14 year old girl with osteogenesis imperfecta.

Sent to us by the neurosurgeon. She has 50 screws and bolts holding her together. She all of a sudden developed positional vertigo. The neurosurgeon thought it was compressing her brainstem. Sent us to find out if it was BPPV or in fact, was she a candidate for brain surgery.

Let's see what happens.

Okay. Chin up, dear.

That's a dizzy, honey.

Okay. My eyes going crazy. Yeah. So she has a predominantly what I'm teaching residents. That's why I'm trolled saying this.

I don't know what that is. Okay, let's see if it stops. Yeah. So see, it's slowing down. I'm testing her.

See that right PC, it doesn't last long in a modified hall pipe, but it's actually horizontal. So I know immediately it's a horizontal canal. So it was beating to the left. So there it is. Even though it's in a modified hall pike, it's still horizontally.

So my next step is to put her in a horizontal position for treatment. Yeah, it is. Okay, I like this. If it was brain stem, it would not stop that as it was. Here's what I need you to do.

Can you turn your head? Now I'm treating her and away. This, this hand like the pillow. Can you turn your head towards the right? There you go.

Oh, goodness. Is you dizzy there, honey? Okay, just stay there, honey. See, the fact that she's dizzy there is good. That's a good thing.

Yeah. How is that a good thing for me? It's a good thing for you because that's usually what happens when somebody's getting better from this. Mommy's got chicken right here.

Now I'm going to check her in that PC position because that did provoke. But I'm also gonna check her, of course, in horizontal.

Yay. Brianna's cured. Brianna's all better.

It's the first time we haven't been dizzy in how long.

Now let me show you another wheelchair. Bounce up. I'm showing you three cases of wheelchair bound kids. So this idea that. Oh, it's.

There's a treatment for everyone if you don't limit yourself to an Epley. There's Gans repositioning maneuvers. There's some maneuvers you can treat virtually anyone if you understand that you select the treatment based on the mobility issues of the individual. Now this is a 13 year old. He's a paraplegic, wheelchair bound, who wasn't out MVA and both his parents were killed.

So he has psychological Overlay. And he's being raised by his grandparents. Very difficult case. So it takes our entire team to take care of this young man.

Open staring contest. We got you. Eyes open. Eyes open. Eyes open.

Big, wide eyes. You're doing awesome. We got you.

What you notice is you don't need video goggles to treat people. And with difficult cases, it only gets in the way. You can see all the nystagmus. Remember, nystagmus from BPV does not suppress with

vision.

We're using a Gan's repositioning. Rolling him.

Right. So what are some pearls? Okay. Children have audio vestibular systems. Testing can begin as young as three months of age.

Don't depend on whether the child has normal hearing or not, unilateral or not. Don't believe if they have a unilateral loss that they will have spontaneous compensation. Not true. Behavioral screening protocols are a good. Very good, excellent indicator of function, which then can proceed to electrophysiological testing.

And remember, undiagnosed and untreated vestibular deficits in children pose safety and quality of life issues.

So muchas gracias. Obrigato. Thank you very, very much. Shoukran. Thank you for attending the program, and I look forward to answering any of your questions.

Thank you, Dr. Ganz. So I just want to remind everyone, when Dr. Ganz mentioned earlier that when you view this course on your own. So this course will be posted in the next few days as a recorded webinar. And when you. You can go back and view the recording and take your time and rewind those videos and watch them again.

So I do see we have one question now, and I invite other questions in the Q and A as well. Yeah, Carolyn. Also, what we can do is we have so many videos. If anybody has questions, we can actually go back into the videos and we can take time that I can kind of walk them through what I'm doing. That will be wonderful.

Let's do that. Let we have one question first to kick us off. Why can't VEMP be tested younger than three months? Is it related to the VCR development?

Great question. It has to do with the neck musculature. Because remember what we're trying to do with the cvemp. The CVEMP is an off response where the OVAMP is an on response. So we need that SCM in contraction to be able to record the cvemp.

So we need that infant to have enough muscular maturation of the neck muscles, specifically the sternocleidomastoid muscle. To give us that nice strong contraction that we can measure the potential off of. Excellent. Thank you. So the next question asks, can you please review testing using an office chair pre and post rotary?

And then this person added, thanks for all you do.

Okay, so office chair, pre and post rotary. First of all, I'm going to give you a billing coding caveat.

Some people, from my understanding will use an office chair and try to bill CPT code 92546. I'm going to be straight with you. This is illegal. It's inappropriate. You could check with aaa, with ASHA, with any of the gurus of billing and coding.

You should not be using an office chair ever. And building billing 92546. Sorry. That's a behavioral assessment. You can look at the Federal Register.

You can look at the AMA CPT description. So let me state that first and foremost. So what you can do with pre and post rotary with the child. Well, do you want to play? So you can.

Now you can do this even with mom holding the child. So you have mom hold the child. Hold the child. Have mom hold the child's head. And you're going to turn the child, right?

And you can turn, turn the child and then stop and then look for the eye beats and just like a rotary chair in the opposite direction. But remember, you can do a V hit with infants as well. You can do a bed. If you don't have a video head impulse test, you can still do a bedside video head impulse test. Remember, most of these infants are going to have a bilateral loss, so you're going to get an abnormal corrective saccade when you move the head bi directionally.

It won't be like an adult with an acquired unilateral. It'll usually be bilateral. The other thing you can do, Let me see if I have this opto.

Here we go. There's an app you can get on your phone called Optodrum, right? And you can get it on your phone. And the optokinetic reflex.

The optokinetic reflex is fully developed by a week after birth. So you can take a smartphone that is producing optokinetics and you can actually have it up to the baby to see if there's an optokinetic reflex bi directionally. So you have a lot of tools that you can begin to use. But I would say that if you have an infant that fails a newborn hearing screening and then subsequent OAEs evoke potentials, whatever you're doing kind of validates. Because remember, we're doing CI implants Now as young as what, nine, ten months of age.

So if you have an infant that is a CI candidate, I would urge you, urge you to do a comprehensive vestibular assessment. Now, why do you want to do that? It's not because the CI is going to possibly hurt or damage the cochlea. It's what you don't want to have happen is you have great results with the CI and it's activated. The child is developing language and at 18, 20 months, man, the child's babbling where the speech path.

People are thrilled. But now they have to lay motor milestones. Now mom and dad are freaking out. What did you do to my baby? You damaged my baby.

My baby was fine. Your baby wasn't fine. Your baby didn't have vestibular function when the implant was done nine months ago, but nobody looked at it.

I've got several textbook chapters and other articles that you can look at at the importance of evaluating not just children, but adults Pre and post CI.

Excellent. Thank you. Dr. Ganz. You know, we, we do have a few more questions about billing and coding. Where would you have folks go, Dr. Ganz, for that expertise on billing for vestibular?

Well, I would go. I would suggest you go to Asher and aaa.

That's right. I would also suggest that if you are in an in. Here's the other thing that the big thing people misunderstand. As an audiologist, you are paid the exact same codes and amount as the country's top ENT and neurologists. The seven vestibular codes that are used.

I worked with Medicare as a co author in 28 states. Medicare will only pay audiologists, ENTs and neurologists for these seven codes in 28 states. Would you believe in all these years there's never been a stark amendment violation brought up against an ENT or an audiologist? Even though. Oh, oh, we have to work.

If you speak to health care attorneys who are truly experts, they will give you a little bit different viewpoint of the legality versus sometimes people that are billing or coding folk. I'm just telling you the law is what you have to look at. The Federal Register is the best real source for what it is. So you don't

want people to. I'm going to interpret what I think this means.

Go right to the Federal Register. That would be my advice. Now that's as a person that for 35 years has probably built out a half a million cases on Medicare and insurance.

That's great advice. Thank you. Zero audits, zero issues. Just saying. Perfect.

We Have a good question here, and I think it relates to the patient you showed with Charge syndrome. How do you tell the difference between poor muscle tone on the exercise ball and vestibular impairment? I don't know if we want to go back to that video. We can. Sure.

Okay. Let's.

Let's look at.

Let's look at this one, for example.

Are you there? All right, so notice as I'm bouncing her, and we can look at a few. Her head. Her neck is stabilizing her head. See, that's the key.

The neck is stabilizing the head. The torso stays above the hips and the pelvis. Let's look at another one.

What you'll notice here is. See how floppy the neck is. The neck is floppy, the torso is floppy, and it's only made worse with the perturbations. So what I want to do when I talk about a perturbation is I don't want to just go up and down. I want to go a little bit forward.

I want to go a little bit back. I want to go side to side, right? I want to try to tilt. I want to make it more difficult.

Again, with this little girl, you can see how her muscle tone is. She almost looks like she's. We took her out of a. Out of the wash, and she's wet and limp. That's the easiest way to.

To look at this. The other thing that you'll find with these children. See how the head flops. And even just standing on a trampoline. Look at the other normal children.

Look at. Look at our little superstar here, this little girl.

Now, this girl's only 30 months.

Look at her ankle strategy. Look at her muscle tone. See? And once I see she can do this. Now, I'm pushing the envelope a little bit.

Now, look, she doesn't say, oh, I want to lay down on the ground. She wants to jump. She wants to play, right? Again. Look how the neck keeps her head stable, right?

Her head, her neck, and her torso is over her pelvis. She's not like.

It's not like too many gin and tonics.

Perfect. Thank you. I think this ties in great because I just saw we passed a slide on Lando reflex. One of the questions was, can you explain that again, if we want to go back to that slide? Sure.

Let me.

So let's work into the landau for a moment. One of the easiest and quickest ways to check babies is on this little physio ball. Now, what you may have noticed in all these normal kiddos is you see how I'm gonna. You see that prone, this little guy is on his forearms with his head up. You're seeing that with every single kid right now.

The other thing is again, make sure you have dry hands. You don't want to drop any babies. But what you really want to do is using mom or dad or significant family member is. Let's see. Remember, as an audiologist, we think about the vestibular, the inner ear as an organ of hearing.

Think about the inner ear as a gyroscope. It's a gyroscope. The otolith system is a gravity sensor. The semicircular canals are velocity detectors. These systems work in tandem.

So when we put this vehicle into a gravity challenged position, a normal vestibular system, the reflex will try to bring itself upright. And that's what you kind of see there.

Let's bring you over to another one with a Landau. Yeah. So this. Okay, now watch the legs kick up. This is part, this is part of the vestibulospinal reflex.

This is what I call flying the infant. See the legs kick up. And I'm going to do this multiple times. Now let me also explain. Explain.

The mom and dad or family members are right there with me the whole time. So I'm not taking the, the a 30 minute intake. I bring the family in with the child, we start playing. I start watching what the baby's able to do. I have a scribe, I'm talking to the parents, asking them about history of the child while my scribe is dictating.

And preferably we're videotaping so we have an accurate record. But we don't do things just once. We're gonna do things multiple times to make sure it's not just a fluke. Now you've gotta get comfortable handling infants. Now if you're a parent or, and you are used to having infants, you're, you're comfortable with it, but the more comfortable you are, these children will not cry, they will not protest.

The parents are right there, they love playing the games with you. And you're gonna move from activity to activity. We're not just gonna do one thing, we're gonna, and we can come back to it. See again, the prone position. I didn't ask the child to do this.

It's not a photo op. See the legs kick up again even with that situation. So I can see the, the Landau reflex on a physio ball. I can see the Landau reflex flying the infant.

Now when the child gets to be four, three and a half, four and a half. Depending on the size of the child, then the physio ball, you know, you're probably not gonna try to lift them. But the physio ball is a great tool. What you also notice is I make sure there's a safe environment, right? So we've got our mats, you know, so the child is comfortable and safe during this whole time.

Thank you, Dr. Gan. So we have two questions here on vestibular hypofunction. So I'm going to combine them. One says, what do you say to parents of infants that have bilateral hypofunction regarding outcomes? And the other question is, what would be the recommendations in terms of treatments?

Two great questions. Okay, so let's talk about total vestibular loss, let's say, in a deaf infant. Severe to profoundly deaf infant identified as CI candidate. Well, Charlie Della Santina at Hopkins, you know, they are making progress with combined vestibular cochlear implants. In fact, Raymond Vanderburgh in the Netherlands is doing some really great things.

So the reality of it is that I think our friends in otology are really getting close to having a combined implant. So we've got to keep our eyes on this. In the meantime, a child without peripheral vestibular function cannot be normal in the traditional sense. They are always going to be visually and surface dependent, which means they are going to need their eyes and their sense of touch to keep their balance. So what that means is they're going to want to.

We're going to want to work with pediatric ot, pediatric PT to try to develop core strengths. We're going to have to supplement that with Mommy and Me Gymboree, anything that helps strengthen, because we're going to be working on the theory of substitution. In the absence of vestibular input, we're going to have to use vision and vestibular to make a greater contribution. Now, in areas of hypofunction, if it's unilateral and we have intact one propeller. And then we're going to try to attempt compensation.

But remember, vestibular compensation. The theory and the utilization and the success is based on having at least one intact mechanism. So if we have a unilateral hypofunction, one intact, I think we have a fairly good prognosis if it's bilaterally hypofunctional.

Again, pediatric ot, pediatric pt. But the caveat to the patient here is, you know, Susie is likely going to need her eyes and her sense of touch to really keep her balance. So we're going to have to be Mindful of that, as she gets older, we're going to look at her motor milestone development. This is why if you have access to, you know, computerized dynamic posturography, I know it's not as popular as it used to be, but that's a wonderful way to evaluate the contributions of vestibular vision somatosensory, to see if the child or adult is in fact making better utilization. But you can do some other bedside tests that our physical therapists do, dynamic gait index, other kind of bedside tests that, that, that are standardized.

Great. One follow up question to this case, are both dynamic and static compensation addressed in this case?

Okay, so dynamic static compensation. So let me, I think I'm going to answer the question. But so if you're trying to get recovery of the vor, if you have a bilateral loss, there is no recovery possible. If you are going to look at central compensation of the vor, then you must, because of the frequency. So the VOR has a frequency range of about half a cycle to six cycles per second.

So if you are not moving and if the activity that you are using to try to force compensation is not moving in at least the frequency range of the vor, you're not going to get good results. Right. So static, just eye movement, you know, doing eye movement alone, these kind of things. Susan Herdman, Susan Whitney, many people have written and myself have written about the importance of when you're doing vestibular exercises, you make them dynamic and interesting and challenging as possible. The brain can't fix what the brain can't see.

The brain has to see the errors in order for the brain to begin the process of central compensation. Remember, this occurs in the flocculus and the brain stem and in the cerebellum.

Great. We are at the end of our time. But we have two more questions. I'm happy, I'm not going anywhere. All right, it's not a pool day.

Quickly, these people have been sending in some great questions. So one is, you haven't mentioned doing ovemp. Is there a reason why not? No, there is no reason why not. We love ovemps.

We're huge believers in ovemps. But here's the thing.

When you're dealing with infants, you don't always have a lot of real estate, right? So it's a little difficult to get all of the electrodes on the little tiny faces. The CVEMP is, is a much more robust and reliable. Because the OVIMP is an on response. Right.

We've got to get the infant to look up, which can be done. Now the ovamp, I would say if you, if you've got a child, you know, three, four years old, the ovamps will work great. Remember also that the ovamp is the same. You're getting this a lot of the same information. True, it's from the sacral, but you're getting a lot of the same information as from the V hit, right?

Because you're looking at the, you're looking at the, the, the superior portion of the nerve. So that's why the cvemp, see there is no substitute for the cfam. See, that's why the vhit, for example, has replaced the caloric almost everywhere in the world. The VHIT is the go to. But the VHIT with a cvemp, because now you've got, I've got both the upstairs and the downstairs of the peripheral system.

Oh, that's a good way to look at it. Well, I love this last question because it's forward thinking. It's a great one to end on. So do you think we should be doing more as audiologists in prenatal auditory development and potentially testing early hearing developmental landmarks in utero before birth?

Well, way above my pay grade.

Okay, I'll ask you an easy one. How long should it take for pediatric vestibular assessment?

So Harvard Business School answer. It depends. Now, at aib, because of our mission, I would spend as long as necessary with any child just because we could afford it. We were not motivated by financial. I was the boss and it's good to be boss because I felt it was the right thing to do.

You don't do less with children, you do more. So now if you want to just do behavioral screenings if the child is not on the spectrum, if you get a referral and your child is, and the child is on the spectrum, you may never get behavioral or almost. It could be very difficult. But if the child is otherwise developmentally okay, you can do screenings easily in 20, 25 minutes. And what would I would do?

I would do trampoline, physio ball, look for Landau reflex VHIT vamp. I mean the V. Right. So the horizontal V hit and a cervical vamp you can do in minutes. So it's all about time management and being efficient and not eating up 15 minutes talking to the parents.

Perfect. Well, I think we have to have you back for Dr. Gan's Ask Me anything because I love all these questions that came in. Dr. Gans, thank you so much. Thank you for sharing my pleasure with us. It's been a great way.

We say save the best for last, but here at Audiology, we save the best for first. So thank you for coming off our webinar series this year. And we hope to see all of you participants in our next webinar, which will be in two weeks, another one in partnership with the Academy. Thanks, everybody. Sounds great.

Have a great day, everyone. Bye. Bye. Bye.