Grand Rounds: Cases in Medical Audiology, presented in partnership with The Ohio State University

Presenter: Gail Whitelaw, PhD; Abigail Smiles, AuD; Breanna Langenek, BA; Devan Lander, BS; Hailey Long, BA; Theodora Bowman, BA

- [Christy] It's my pleasure to welcome back student clinicians and Dr. Gail Whitelaw from the Ohio State University. I'll hand it over to you, Dr. Whitelaw, to introduce everyone.

- Thank you, Christy. Welcome to all of you. We're glad you're here today. This is the number of times that we've done the grand rounds with AudiologyOnline, and we're very, very grateful for the opportunity. And I'm a little nervous today because I think we've gotten overzealous about some of our cases. We have a lot to share and they're incredible cases, and I hope you enjoy them very much. But because of that, we're going to ask that people post their questions. However, we're gonna hold them till the end. And if we happen to run out of time, we will make sure that you have access to all of the presenters to be able to contact them and discuss the cases more.

With that said, we have six presentations, six case presentations in the next hour and a half, and most of them are related to medical audiology in some way. And medical audiology in our case today means both physical health and mental health and the role of audiologists in each of that. And I'm very excited about our presenters because as many of you know, these are all people who are either recent graduates from Ohio State or are current graduate students in the AUD or the AUD PhD program. And I think it takes a lot of courage to put yourself out there early in your career, and I'm very proud of the folks who are gonna present today. And I think you'll see why, because their cases are fascinating and they will do such a great job of talking you through some things that hopefully will be new to you and exciting for you.

So with no further ado, I would like to introduce our first presenter, who is Devan Lander. Devan is an AUD PhD student in the program at Ohio State. And I will forward her slides. And we also have presenter disclosures that you need to take a look at to know about each of us and our disclosures. But we'll go ahead and talk about some learning outcomes also. And one of the things I've already mentioned is that

interprofessional practice in audiology continues to grow as an area, and I think the cases that we present today will be interesting from a hearing and balance perspective, but also how we as audiologists can function and are expected to function and can contribute in that world of interprofessional practice. So with no further ado, I will turn it over to Devan Lander and her case in traumatic brain injury with concurrent facial palsy, which it is truly a very unique case. Devan.

- Thank you, Dr. Whitelaw. Yes, so today I'll be talking to you about a patient who had a history of traumatic brain injury with concurrent facial palsy. And like Dr. Whitelaw said, these are two things that don't happen together very often, but they do happen together. So to give you a little preview about what we are going to talk about today, so we're gonna first talk about the context and the background for the case. We'll talk about the case itself, some tools that you as audiologists can use to kind of help you assess these patients, and then also talk about the takeaways from this case. Okay, so first let's talk about traumatic brain injury. So traumatic brain injury in general has a really high incidence in the United States.

And if we're thinking about the adult population, our young adults and our old adults are the highest risk categories for traumatic brain injury. The CDC also classifies traumatic brain injury as a silent epidemic because people who have had a traumatic brain injury walk around among us and we would have no idea in most cases that that is something that they've dealt with. Traumatic brain injury's relevance to audiology is that some of these people, after a traumatic brain injury, have auditory complaints, and those might look like difficulty hearing in background noise, trouble hearing in groups, having a hard time understanding rapid speech, challenges remembering spoken information or instructions, which also might be considered auditory working memory, and also auditory fatigue.

So that just means after listening all day, they feel really fatigued. They also might face disruptions in their functional communications because of these things that they're experiencing. So they may not feel like they're able to function in their day-to-day life as well as they were able to before the traumatic brain injury. Another thing to consider as audiologists for these patients is that hearing difficulty might go undetected by the conventional audiometric battery. And that's because these patients don't always have hearing loss that accompanies their traumatic brain injury, or they may have a little bit of hearing loss, but not enough that you would think it would explain the severity of their complaints. All right, now we're gonna talk a little bit about facial palsy.

So facial palsy refers to weakness or paralysis of the face. A lot of times people think about this with stroke or maybe Bell's palsy, and it has to do with facial nerve function. So something has disrupted the function of the communication between the face to the facial nerves. So in the case of traumatic brain injury, facial nerve function is disrupted by the incident itself. So usually it happens by the crushing of the facial nerve itself due to that rapid disruption of the head caused by the traumatic brain injury. And this can have physical and emotional consequences such as lack of control over the facial structures, dental issues, pain in the face, difficulty with speech production, facial spasms, and also some social-emotional consequences, such as decreased self-esteem, higher rates of anxiety and depression, as well as maybe some difficulty communicating.

So together these two things, traumatic brain injury and facial palsy specifically in this case, the facial palsy usually can occur immediately or have a delayed onset, and it typically is noticeable within 72 hours of the incident. And it can be accompanied by pain, hearing loss, altered taste, and altered facial sensation. And so with a person who has traumatic brain injury and facial palsy and likely hearing difficulty if they're showing up in your office, you're juggling three different things that have some pretty significant social and emotional consequences as well as just functional consequences to their

day-to-day life. Okay, now let's talk about the case specifically. So this person had a motor vehicle accident in 2022. As a result, they reported hearing difficulty and memory loss as well as some physical symptoms including facial palsy.

They also reported occasional bothersome tinnitus. Before we saw this patient in our clinic, they had already seen a speech-language pathologist, a physical therapist, and an occupational therapist. And this can be the case with people who have a history of traumatic brain injury because oftentimes they're gonna treat those acute medical symptoms before they pursue treatment for their hearing difficulty. And they may not even notice that their hearing difficulty is an issue until some of these really acute medical symptoms have passed. So it might be, you know, a little while before we see them in our offices. Okay, now let's talk about the testing that we did for this patient. So the first thing we have our traumatic brain injury patients do who are reporting hearing difficulty is fill out a couple of questionnaires.

One of those is the adult auditory processing scale, which gives you an idea of their listening difficulty in six different environments, which you can see here on the Y axis. To give you the acronyms, the first one is auditory memory sequencing, auditory attention span, and multiple inputs. So those are just kind of different situations that the person might be in. The gray bars represent what would be considered the normative range, which was established by Roup et al. And these stars, these red stars, are where our patient was. So you can see that they're way outside of what we would consider normal hearing difficulty, and that they are struggling in every environment, even in a quiet and ideal environments.

Next, we did some behavioral testing, and typically what we do is the SCAN-3 and potentially another speech and noise test. But this patient specifically had a lot of test anxiety surrounding any kind of listening tasks, and so we only completed the screening. And the results of this screening were enough to tell us the story of kind of

what's going on with this patient. So in the screening, it includes gap detection, auditory figure-ground, and competing words. So with the gap detection, they were not able to consecutively detect any gaps in noise. For auditory figure-ground, in this little chart here you can see what the passing score is by the gray bars and what the patient's score was.

So you can see they did not pass for auditory figure-ground or for competing words, indicating that likely, if we were to do an entire battery, that this patient would still qualify as having an auditory processing disorder. So now let's talk about the tools us as audiologists have to use when addressing patients who have traumatic brain injury and listening difficulties. We really wanna use a combination of behavioral and subjective measures. And one of the subjective measures that we have found really useful is the adult auditory processing scale. And so just to give you some preliminary data, which the AAPS has developed in the lab that I work in, for young and middle-aged adults with TBI and a control group, individuals with TBI have significantly greater scores on the AAPS.

The AAPS is also correlated with their speech and noise performance, auditory working memory performance, and temporal processing. So these AAPS scores can be a really good predictive tool to kind of give you a good idea of maybe what they would do behaviorally. And in audiology, I remember one of the first things that we learned was, you know, we wanna put those puzzle pieces together, and as we're moving along in a case kind of think about how we can predict maybe what we'll see next. Okay, the next thing I wanna talk to you about is just the individual variability of traumatic brain injury patients. So this is that same study, and for the study we did four tasks as you can see, task 1, 2, 3 and 4.

And then we had 10 traumatic brain injury subjects. Each of the tasks tapped into a different area of auditory processing. And what's important about this little chart here is

you can see that they all perform differently. So the dark red indicates two or more standard deviations below a normal score, and the light includes one or more standard deviations below the normal score. And ASHA recommends two or more tests with two or more standard deviations outside of the normal score. This particular data comes out of a mild traumatic brain injury population, and so you can see some of them don't necessarily qualify with the ASHA standards, but the point is is that these people are having difficulty in multiple domains of auditory processing.

And as clinicians, depending on what tools we have available, our behavioral tools may or may not be sensitive enough to detect their specific problem, right? Because we might be limited by what we have available to us in our clinics. And that brings me to the conclusions, which are traumatic brain injury can be accompanied by a wide array of other disorders and symptoms. And because of that, we as audiologists might not see these patients until later in their journey. They also might not even know that we are the appropriate professional to help them address their hearing difficulty, so that's another layer that they kind of get to us later in their traumatic brain injury recovery journey. Another thing is, and that kind of covers points one and two, is we might see them after the acute period of their injury.

And then we also want to use a combination of subjective, behavioral, that word's missing in there, and objective testing to reveal that auditory difficulty. Because the more information we can gather, right, the better. And like I said before, we might be limited to what we have available in our clinic, but getting the most holistic view of the patient is gonna give us the most tools to be able to make the appropriate referrals if necessary, and/or also choose the appropriate treatment recommendations. And finally, every person with a history of TBI is unique, and you're never gonna see the same one twice. So every time somebody like this walks into your office, they might need something different from you than the last person. So it's important to remember that as you see these people in your clinics. And here are my references. Thank you.

- [Dr. Whitelaw] Thank you, Devan. Very interesting. Thanks so much for sharing that with us. Our next presenter is going to talk a little bit more about traumatic brain injury. Our next presenter is Abigail Smiles, and Abby is a recent graduate of the Ohio State University and has significant interest in traumatic brain injury because one of the interesting facts about Abby is she is both a speech-language pathologist and audiologist. And with what she's going to talk about today, that's a very powerful combination. So with no further ado, I'll turn it over to Abby.

- Thank you, Dr. Whitelaw, and thank you, Devan, for that first case. That actually was a wonderful introduction to my case. So I'm going to be talking a little bit more about the audiologist's role in traumatic brain injury rehabilitation. Just a brief review of the topics we're going to talk about today. I'm going to briefly go over traumatic brain injury. We'll talk about my case, we'll talk about the results and the treatment recommendations that we made for her, and then we're going to follow up and see how she was doing after the treatment. I'm going to end with talking about some special considerations for audiologists working with the adult TBI population because prior to seeing this patient, this isn't really something that I had thought about or considered.

So first off, Devan gave a really wonderful introduction to traumatic brain injury so I'm just going to briefly go over my slide. Traumatic brain injury or TBI is broadly defined as any injury that results in disruption of the typical functioning of the brain. We can describe it further by describing the mechanism of injury such as falls and motor vehicle accidents, the severity of the injury which can range from mild to severe, and we can also think about the site of lesion in the brain or global damage versus damage at a cellular level. Two areas in the brain that are commonly affected during a traumatic brain injury are the frontal lobe and the temporal lobe, which are very important areas for cognition and communication.

Like Devan mentioned, TBI is highly variable. However, folks with a TBI are at a higher risk of experiencing several audiologic and balance symptoms following their injury. These can include peripheral hearing loss, however, this is not always the case, auditory processing disorder, balance disorders or vertigo, tinnitus, and sound tolerance disorders such as hyperacusis, which is an abnormal sensitivity to sounds. Some non-auditory symptoms that may also indirectly impact listening and communication include cognitive deficits such as in the areas of memory, receptive or expressive language, attention, and executive function. So the subject I'm going to be talking about will be referred to as Ms. M. She's a 34-year-old female status post a mild traumatic brain injury that occurred in November, 2021 from a motor vehicle accident.

She was hospitalized for one day to address those acute medical needs and make sure that she was medically stable. And then in the meantime before we saw her, she had been receiving several services including speech and language therapy and vision therapy. Months after her accident, she was continuing to experience significant communication difficulties and auditory symptoms including abnormal sound tolerance. A lot of environmental sounds were excruciatingly loud for her and she couldn't tolerate them. She also had bothersome intermittent tinnitus that would come on and cause a distraction for her when it was present. And she also had significant perceived difficulties listening in noise, which were greatly affecting her quality of life and ability to participate in her daily activities.

So she actually had mentioned this to her speech pathologist who kindly referred her to the Ohio State University Speech, Language, and Hearing Clinic for further evaluation. And I saw her for the first appointment on March 9th, 2022. At this appointment, she was accompanied by her mom, which was excellent because her mom was able to provide some additional case history. At the appointment she reported that her goals were reducing distress from her sound tolerance issues and tinnitus, improving her

ability to listen in challenging environments such as out at restaurants, and eventually she wanted to return to work as a high school teacher as she was unable to do this since the accident due in part to her auditory symptoms.

So for our assessment, we did a pretty thorough assessment on her. I took a really thorough case history. We had her complete several questionnaires. The two that we had her complete were the tinnitus reaction questionnaire or TRQ, and also we have a clinic-specific hyperacusis intake questionnaire that we give to our folks with suspected sound tolerance disorders. Other questionnaires that you can administer to these patients include the AAPS such as Devan mentioned or the hearing handicap index for adults or for the elderly. We also did some otoscopy and immittance, which is very important in folks with traumatic brain injury, especially if they're in the acute phases of the injury. We wanna rule out any ossicular chain injuries or any foreign objects in the ear.

And then we did our standard audiometry battery along with some speech and noise testing and auditory processing testing. So this is her audiogram that we completed at that first appointment. You can see her hearing is largely within normal. She just has that mild hearing loss at 8,000 hertz in the left ear only. Her speech audiometry in quiet was excellent as well. She got 100% of the words correct at a normal conversational level. However, when we moved on to some speech in noise testing and made some things a little more challenging for her, she really began to struggle. So we administered the R-SPIN or the revised speech and noise test. And for those that are unfamiliar with this test, it consists of sentences that are presented in multi-talker babble at a plus eight dB signal to noise ratio.

Sentences are grouped into categories based on high predictability or HP, sentences that have a lot of context that patients can use to help them understand what they're hearing, and low predictability, which lack context. So during this test, the patient

hears a sentence and they're asked to repeat the final word of the sentence. You can see that she got 76% of the high predictability words correct. However, when we removed the context, she got 0% of those words correct, so she really, really struggled. We moved on and did the SCAN-3-A battery. She failed all of the screening tests, and so we went on to the full battery. And her scores are displayed in this table right here, the percentile ranks.

This assessment showed overall global deficits in auditory processing skills. One thing I just wanted to point out is for the competing words directed ear subtest at the bottom, we unfortunately didn't have time to complete this subtest, but the competing words free recall was abnormal and so it's assumed that this would be abnormal as well. It would be nice to have that information, but it's not really going to change our directions for treatment. So where do we go from here? She has essentially normal peripheral hearing sensitivity for pure-tone stimuli and normal word recognition performance in quiet. However, she has significant self-reported difficulties with listening and speech understanding, sound tolerance, and tinnitus. One thing I noted during the first appointment with her was just us speaking in a normal volume was sometimes too loud for her.

She frequently asked her mother to kind of lower the volume of her voice even though she was speaking in what I would consider to be a normal volume that was too loud for Ms. M because of her sound tolerance disorder. We also have a lot of objective evidence and behavioral testing that supports auditory processing deficits and listening in noise deficits as well. So what do we recommend? For her tinnitus and hyperacusis, we recommended a referral to a cognitive behavioral therapist to help her deal with those negative reactions and the anxiety that were surrounding those conditions that she was dealing with. We also recommended some sound therapy. Sound therapy is the use of environmental sounds, recorded sounds, and/or music to reduce the contrast between a patient's tinnitus and their environment.

It's important to note that the goal of sound therapy is not to mask or cure tinnitus. The goal is to promote habituation. So she was encouraged to use that sound therapy during those times where she did notice her tinnitus. Quickly diving into the research surrounding these two treatment approaches, overall, the research is kind of in its infancy currently, but I was able to find a few studies that supported the use of both of these treatment methods. The first one for sound therapy, I found a study by Formby, Yang, and Scherer from 2022. They divided patients with tinnitus up into three groups. One used an ear level broadband noise sound generator, one group received counseling only, and the third group received both of those treatments.

And what they found is that the use of an ear level broadband noise generator resulted in subjects experiencing noticeable improvements in tinnitus perception over a shorter time interval. It didn't increase the magnitude of treatment effects, but patients noticed benefits sooner, which has really important implications for treatment adherence. Cognitive behavioral therapy, it's really important to note that this is actually not done by audiologists. This is provided by a mental health professional. There's overall limited evidence surrounding the use of CBT for patients with tinnitus and hyperacusis. However, I did find a study that supported the use of CBT and association with lower scores on a hyperacusis questionnaire. The third treatment that we recommended was a trial of mild-gain amplification, and the goal of mild-gain amplification is to enhance speech understanding in difficult environments by improving the signal to noise ratio and enhancing soft consonant sounds.

Benefits of mild-gain amplification for individuals with normal hearing but subjective listening deficits can include reduced perception of their listening handicap, improved ability to hear speech and noise, and reduction in the perceived effort that they need to use in these challenging environments. We can also supplement this by the use of assistive listening devices such as a partner microphone or a Roger system to further

enhance the signal to noise ratio. So specifically for Ms. M, we fit her with a set of Oticon MORE 1 mini RITE hearing aids with 60 dB receivers and double-bass domes. One thing to note, even though she does have normal hearing, and we typically wouldn't choose such an occluding style for an individual with essentially normal hearing, we chose this double-bass dome to allow her to receive the full benefits of the signal processing and noise reduction features of those devices.

We set her NAL-NL2 prescriptive targets by adding 10 decibels to her pure-tone thresholds, and we also added additional high frequency gain to enhance those soft consonant sounds and increase speech clarity. So these are her regular results that we got after fitting her with those mild-gain amplification devices. One thing to note here is that we are above target for almost every frequency in both ears, and that is okay in this case. The really important thing that we wanna consider is that we need to provide her with enough gain that she can access those signal processing features. We also verified that the hearing aids were comfortable for her and not too loud, which is especially important due to her hyperacusis.

She was happy with the sound quality and the volume of the devices. So we followed up with her a few weeks later and she reported significant reductions in the amount of difficulty that she was having and the effort that she had to use when listening. She was thrilled with the devices. She said that, "These hearing aids have changed my life," which is always a wonderful thing for patients to say. And even better, her family was also commenting that she appeared more relaxed during conversations while wearing her devices. She was also able to go out and do things that she hadn't been able to do previously, like going out to eat at a restaurant with her family.

We also gathered some objective behavioral data. We repeated the R-SPIN while she was wearing her devices and her score on those low predictability words jumped up from 0% unaided to 85% aided, which is an excellent result. Regarding her tinnitus and

hyperacusis, she reported subjective improvements in the severity of both disorders. That's since starting care with audiology. She said that the CBT has been very helpful in managing her negative emotional reactions to sound tolerance and tinnitus. And on some post-treatment questionnaires, her TRQ score reduced from 44 initially to 24 post-treatment. And there was also a slight reduction in the perceived loudness of environmental sounds on that hyperacusis questionnaire. So I wanna end today just talking about some special considerations for providers who are going to work with individuals with traumatic brain injury.

Audiologists interested in this population should have a basic knowledge about interpreting imaging reports and medical documentation. Remember, a lot of these folks are going to be hospitalized just to ensure that they're medically stable, so it's useful to be able to read those reports and kind of get a sense of how they're doing. Individuals with TBI should also be screened for mental health issues, speech and language disorders, and cognitive impairments when appropriate. So if we think that they might benefit from these services and they haven't received them or aren't currently receiving them, or if they're in the acute phases of their traumatic brain injury, it's always okay for us to screen and then make referrals to the appropriate provider.

Again, it's really important for us to be familiar with the scope of practice of other providers so we can provide those referrals. And finally, we need to consider each individual's cognitive and communication status, and we need to modify our communication or test instructions to make sure that they're successful. This can include things such as breaking up testing into shorter intervals if a patient is getting fatigued, having a family member present to provide case history information if the patient is struggling, and using simple directions and repetition. Some final thoughts on this case. As Devan mentioned, TBI is highly variable. Two individuals with traumatic brain injury will not be the same. And we can have a wide variety of auditory and non-auditory symptoms that can affect communication.

Us as audiologists are uniquely qualified to work with individuals with TBI and other neurological disorders involving the auditory system. We've received a lot of training about the central auditory pathways and areas in the brain that are responsible for auditory functions. And although research into the assessment and treatment of the TBI population is still emerging, this is a really exciting area for the future advancement of our field. You know, especially in the era of OTC hearing aids, it's important for us to remember that we have a wide range of services that we can offer to these patients. And here are my references. And thank you very much.

- [Dr. Whitelaw] Thank you, Abby. That was an outstanding presentation on Ms. M and piggybacked beautifully onto what Devan was discussing. And I think that it's really exciting to see the progress that she's made and the role that audiology has in that, but also as you highlighted how important it can be from an interprofessional practice perspective for a patient population that often works with an interdisciplinary team. So thank you for highlighting that. Our next presenter is Breanna Langenek. Breanna's got some interesting things to talk about related to the first two cases because she's going to deviate from those. But what you'll hear is some things that may be very, very helpful if you're interested in working with any patient who has speech and noise issues, and also if you're interested in finding out more about ototoxicity, another area that's very important from an interprofessional practice. Breanna's currently a third year AUD student in the audiology program at Ohio State, and this summer is spending her time at NCRAR in Portland, Oregon as a T-35 recipient and doing some interesting clinical research there. So we'll turn it over now to Breanna.

- Thank you so much for that, Dr. Whitelaw. So today I'm gonna be discussing a subject who is undergoing chemotherapy and is enrolled in an ototoxicity research study at the National Center for Auditory Research within the Portland VA. So before we began, I figured I would give just a little bit of background here. Cisplatin is a

platinum-based chemotherapy agent and a known ototoxic drug. It is used to treat a wide variety of solid tumors such as those of the head and neck. Audiological impacts will often look like a permanent, high frequency sensorineural hearing loss with tinnitus. The hearing loss will often spread into the lower frequencies with increased duration and higher doses. Damage to the hair cells and stria vascularis can help contribute to these audiological findings.

And knowing that, let's meet our subject. This subject is a male in his sixties who was diagnosed with squamous cell carcinoma of the oral cavity. Beyond the cancer diagnosis, he was in otherwise good health with no audiological concerns or history. His treatment plan was to receive cisplatin once a week for five weeks, and he was enrolled in the ototoxicity research study at NCRAR, which as I just stated earlier, is housed inside of the Portland, Oregon VA. The only audiological monitoring that he opted to receive was from this research study, which followed study protocols, not necessarily clinical protocols. The baseline results were obtained prior to him starting cisplatin, and as you can see, he has thresholds within the normal range through four kilohertz and then slopes to mild sensorineural hearing loss bilaterally.

Prior to enrolling someone in our study, we administer the mini mental state examination. The MMSE is a questionnaire with 11 questions that allows us to screen for cognitive impairment. And this subject passed. The other two measures obtained were the sensitive range for ototoxicity or the SRO, which is the top right chart, and the spatial release for masking or the SRM, which is the bottom right chart. And let's do a brief overview of these tests before getting into the nitty-gritty here. So the SRM is a form of speech and noise testing that looks at how someone's able to use directional cues to separate the signals that they're interested in, also referred to as the targets, and competing background noise or the maskers.

We run this test under two conditions, one where the signals are co-located and another where the signals are separated. The subject will hear the carrier phrase, "Ready Charlie," followed by a color and a number that they're expected to identify. From there, you'll get a target to masker ratio or ATMR that will allow you to see the impact of direction. And the figure here is showing the separated condition where you have a target and two masker on each side being delivered to the subject under headphones. The SRO is a measure that looks at the upper limits of the auditory system by determining where there's a threshold of 100 dB SPL or less. Once located, you'll do the next six adjacent frequencies in 1/6 octave steps.

The Houston and Westlake procedure is used to determine where that threshold is, and these frequency ranges will look different for every patient as well. This measure is able to detect ototoxicity 90% of the time according to Fausti et al. At NCRAR, we conduct the SRO on the OtoID, which is an extended high frequency portable audiometer that lets us do bedside testing. However, it can be done on any extended high frequency audiometer. So to come back to the baseline SRM and SRO results, you'll see the SRO frequency was 6 to 12.5 kilohertz with corresponding left and right thresholds. When reading the SRO graph, think of it like an upside-down audiogram. For the SRM you'll see the co-located and separated conditions.

The best possible score someone can get on this measure is a negative 10 target to masker ratio, whereas the worst possible score they could get is a positive 10. And the target to masker ratio lets us see how loud the signal of interest needs to be compared to the masking noise. So in this case, when there's a distance component to the signal, the signal of interest can mean 9.5 dB less than the masking. When they are overlapping or there's no distance component, the signal of interest can be successfully detected at 7 dB less than the masking noise. And as you see here, there is a fairly good SRM score. 30 days later, he returns for a scheduled visit. At this point,

he is about to complete his final weekly dose of cisplatin and does not perceive a change in hearing.

Here you'll see his current audiogram. The main change compared to baseline can be observed at eight kilohertz in the left ear with a threshold shift of 15 dB. However, since this change only occurred at one frequency, it's not considered a CTCAE graded shift, which requires two continuous frequencies of between 15 and 25 dB to be considered a grade one or a mild shift. So baseline and visit two data for SRM and SRO are side by side here. The SRM is the bottom right image. You'll see the co-located condition, which is the purple bar, has actually improved since we saw him at baseline. The separated condition, which is the grayish black bar, has stayed the same and not really any concern here for this measure.

However, we begin to see shifts in the SRO of about five to 15 dB. These baseline measures are in red and blue for the right and left ear. The visit two data is the pink line for the right ear, and the gray line is visit two for the left ear. And these shifts of five to 15 dB throw up a red flag to us that a change might occur. Five months after baseline, the subject's seen again at the request due to a high level of concern. He has completed his chemotherapy by this visit and at this point we start to see perceptual changes that when paired with subjective reports show impacts on his quality of life. He's struggling to sleep, no longer wanting to participate in social events because of his hearing, and is now dizzy when he moves his head.

During this visit, this patient had multiple hearing and tinnitus questionnaires administered to him as indicated by the bottom graphs. For each questionnaire graph, the axis represents the highest possible score that could be obtained with the subject's score located on the bars. When knowing the subjective complaints and seeing these questionnaire scores, it's a big indication to us that a significant handicap is occurring. Interestingly enough, though. his audiogram has not drastically shifted since baseline.

And as you'll see on the next slide, there has been a major shift in both conditions of the SRM that has occurred at this visit. And this helps show that monitoring should include measures beyond just the conventional audiogram if we want to avoid potentially missing patients with ototoxicity.

So as you'll see here, there are shifts of five to 20 dB in the SRO. And now looking at the SRM graphs, you'll see major changes have occurred since his last visit, as I just alluded to, keeping in mind that the range for SRM is negative 10 being the best possible condition with positive 10 being the worst. So seeing these scores that went from nearly perfect at baseline five months ago is highly concerning, especially with these reports about quality of life due to his hearing. And then a phone call serves just as a check-in to see how he's doing. And this is six months later now. What we learned from this is that the tinnitus is still persisting and continues to be bothersome.

What he stated is that it's more frequently occurring but is less intense than it initially was. The auditory changes, though, are still continuing to impact his quality of life. Eight months after baseline, another visit occurs at the subject's request. He continues to want monitoring because he's concerned about his hearing and wants to be proactive. He reported that the tinnitus has increased in the left ear and once again still impacting his life. He stated that it's still present in the right ear but not nearly as bothersome. Conventional audiogram, though, does not show changes compared to baseline. While there's not been a significant shift in the conventional audiogram, you'll see fairly large shifts in the SRO compared to baseline across the entire frequency range.

Additionally, we see a major shift in SRM scores bilaterally. As you'll see in the SRM graph, at baseline the subject had nearly perfect scores at eight months, but eight months later, he is at the complete opposite extreme, further supporting the idea that we should be utilizing measures beyond just the audiogram to get a full picture of the

auditory system. With that being said, takeaways include speech and noise with subjective measures are crucial and should be included in monitoring appointments to avoid potentially missing patients who are experiencing these ototoxic effects. To highlight, the SRM and SRO are quick measures that can be done at bedside, easing the ability to early identify patients. Also, if this patient had lacked baseline testing, we would not have known the severity of these shifts.

And in addition, the subject experienced the largest degree in auditory changes after his cisplatin had ended. So had monitoring stopped with the chemotherapy doses, he would have potentially been missed. So now that that's all said and done, what are the benefits to SRM and SRO? With SRM, what we do at NCRAR is we give the patient an iPad which has the Portable Automated Rapid Testing or PART app on it, which is a free app available on the iPad. And this app will then walk the patient through the test, and which ends up being self-administered. There have been times where we'll give the iPad to the patients to do in their hospital bed, and then they'll give the iPad back to their nurse when they're finished in order to just help make testing more feasible based upon the patient's needs.

The app will then ask the patients to match a color with a number, so the patient who's wearing headphones might hear, "Ready Charlie blue five," and they will always hear that carrier phrase of, "Ready Charlie," and they're then expected to match blue with five, almost like a game. And the patient needs to correctly pair a combination twice at any given level before it's accepted as a response. There ends up being 32 different combinations, so the likelihood of potentially guessing correctly is low. SRM also checks for comprehension, which we know is the most complex task according to Erber's hierarchy, and it lets you be able to better understand how that patient is performing in noisy situations. Running the SRO is very similar to conventional audiometry and comes with the added benefit of helping you see which frequencies are most at risk for being impacted by ototoxicity.

It's a quick measure to obtain, and any extended high frequency audiometer can do this test. You are just looking for the highest frequency where the patient has a threshold of 100 dB and then looking for the next six frequencies in 1/6 octave steps. Ultimately, this is a quick test, and as we wrap things up, let me propose this question to you. If you only have enough time to get seven frequencies on each ear, would you rather get the conventional audiogram or would you rather look at the frequencies that are most at risk for ototoxic shifts? And then this is the grant information that helps support this research study, along with thank you to Drs. Dawn Konrad-Martin, Dr. Riley DeBacker, Michelle Hungerford, and Hunter Stuehm, who helped make this possible. And then these are my references.

- [Dr. Whitelaw] Thank you, Breanna. I'm sure people are gonna have questions about accessing the SRM and the SRO after hearing you speak about this, and hopefully we can get to that in the question and answers. But if not, people are welcome to contact Breanna about this very interesting study and the role that audiologists can have in working with patients who have ototoxicity and not just looking at the audiogram. So that was very, very enlightening. Thank you. I now have the pleasure to introduce Hailey Long. Hailey is a third year AUD student at the Ohio State University, and she's gonna take us on a little bit different case of looking at some interesting vestibular issues for a case that she's come across. So Hailey, I'll turn it over to you.

- All right, thank you, Dr. Whitelaw. So today I'll be talking about a possible case of persistent postural perceptual dizziness, which I'll be referring to in this PowerPoint as 3PD. I would like to preface this by saying that this case was seen by an otologist. However, the case history taken by an audiologist played a large role in the otologist's decisions that were made. So first I would like to introduce our patient, Ms. K. She was a 30-year-old female who presented to otoneurology on November 10th of 2022. She complained of daily dizziness that she has been having since August or September.

She reported that it worsens in the car, with head movements, when she's in the elevator, turning curves, and that her spells can last one to several minutes.

It was also noted that Ms. K had nystagmus while looking to the left. She also reported having daily pressure headaches, numbness of the face, hands, and feet. The numbness was worse on the right side. She also had a right eye twitch, and Ms. K denied having double vision, blurry vision, facial weakness, difficulty with speech, and difficulty with swallowing. So a little bit about Ms. K's case history. She experienced her first headache in 2011, which was accompanied by a right eye twitch. During that time she had an MRI taken and it came back normal. She was prescribed Topamax, which is a medication used to monitor or to help with migraine symptoms. However, Ms. K reported that she did not like the side effects of Topamax.

It was causing her to feel nauseous and she reported that she had an overall brain fog as well. Also, Ms. K reported that she had a miscarriage in August of 2011. And following her miscarriage, she began having the daily headaches, numbness, and dizziness, and she suspected that these symptoms were due to the hormone changes surrounding her miscarriage. She then had an emergency room visit prior to her November 10th visit with otoneurology. With the emergency room visit, they took a CT of the head and it came back normal. And then an MRI and an MRV were also ordered. However, at the time of her November 10th visit with the otoneurologist, there was no full report on the MRI taken at the ER, so they didn't have that full report.

However, the otoneurologist who was seeing her at the November 11th appointment, sorry, November 10th appointment, observed a facial nerve enhancing bilaterally, which means that as he scrolled through the MRI, the facial nerves got brighter on both the right and the left sides. Which if you look at the MRI picture provided in the top right hand of the slide, I've circled where he noted there was enhancing of the facial nerve. It can be seen more on our left side. So what is 3PD and how would it relate to

Ms. K? 3PD is defined as having feelings of unsteadiness and dizziness that are triggered or exacerbated by visual and physical stimuli. Currently, the pathophysiology is not fully understood; however, the current hypothesis that is most commonly referred to is that there's a neural pathway in the brain created when a vestibular incident and a visual stimulus and feelings of stress or anxiety co-occur.

And then our brains maladapt to those three triggers at the same time, creating a negative feedback loop, which then feeds into itself. So you'll have a feeling of anxiety and you'll think, "Oh my gosh, I'm gonna get dizzy." And then there's a visual stimulus that then you associate with that, or there's a visual stimulus and your brain goes, "Oh, I was dizzy the last time, now I'm gonna have anxiety." So that kind of negative feedback loop that unless interrupted and rehabituated to break that cycle is going to persist. So there are currently five diagnostic criteria for 3PD, and the diagnostic criteria that was discussed in Staab et al in 2017 has been referred to in other literature as well.

The five criteria include feelings of dizziness, unsteadiness, or non-spinning vertigo that occur frequently for three months or more. So if we think back to Ms. K, she reported that she has been having these daily symptoms since August and September, and it's now November so it's been about three months or more. The second diagnostic criteria is that the symptoms persist or occur without specific provocation, but are exacerbated by three factors, including an upright posture, active or passive motion, and exposure to moving visual stimuli or complex visual patterns. Thinking back to Ms. K, she noted that driving in the car with cars going by her was a visual stimulus that would trigger the dizziness for her. And then the third diagnostic criteria, the disorder is precipitated by conditions that cause vertigo, unsteadiness and dizziness, or problems with balance, including acute, episodic, or chronic vestibular syndromes, other neurologic or medical illnesses, or psychological distress.

Again, thinking back to Ms. K, we know that she went through a period of psychological distress surrounding her miscarriage, and that miscarriage she also attributes to the start of her daily symptoms. And then the fourth diagnostic criteria, symptoms cause significant distress or functional impairment. Ms. K reported that she was no longer able to drive by herself for fear of becoming dizzy while driving. And then daily tasks such as going to the grocery store or just simply going to work were becoming difficult for her. And then finally, the last diagnostic criteria, that the symptoms are not better accounted for by another disease or disorder. And at this point, the MRI and the CT scan wasn't leading the otologist to any other diagnosis.

So is 3PD an appropriate diagnosis? And when thinking about her daily symptom of having headaches, would vestibular migraine be an appropriate diagnosis as well? So there was research conducted by Sarna et al looking at the overlap of patients in their neurotology clinic who met the criteria for both vestibular migraines and the criteria for 3PD. Questionnaires were administered asking patients about their symptoms. 3PD was identified using the diagnostic criteria established by the International Classification of Vestibular Disorders or the ICVD, and vestibular migraine was identified using diagnostic criteria based on the International Classification of Headache Disorders or the ICHD. There were 36 participants in this study who were diagnosed with 3PD. Of those 36 participants who were diagnosed with 3PD, about 53% of that population also had a prevalence of migraine headaches.

And of the entire cohort, 72% were female. So based on this research, we saw that there's a significant overlap in the patients who are diagnosed with 3PD who also experienced vestibular migraines, and it was actually hypothesized that migraines cause 3PDD symptoms to be increasingly worse and last longer. So what does this mean for our patient, Ms. K? Ms. K is currently meeting the diagnostic criteria for 3PD as we talked about in the slide with the five different diagnostic criteria. And one of her primary complaints is that she's having daily pressure headaches. By applying the

research on the previous slide by Sarna et al, when considering treatment options for Ms. K, it might be best appropriate to treat for both vestibular migraine and treatment for 3PD.

So what are our treatment options? Those may include selective serotonin reuptake inhibitors or SSRIs, vestibular rehabilitation, or a multimodal approach. Let's first talk about SSRIs. In a study by Min et al in 2021 based out of South Korea, 197 individuals who were diagnosed with 3PD and prescribed SSRIs were studied. They were told to rate their dizziness by filling out the Dizziness Handicap Inventory or the DHI. And then a clinician also rated the severity of impact 3PD using the Clinical Global Impression Severity Scale or the CGIS. They found that there was a noticeable improvement on the DHI and the CGIS, which was impacted by sex and age. They found that females had better outcomes using SSRIs than males, and that younger individuals had better outcomes using SSRIs than older individuals.

Also, individuals who had higher or poor CGIS scores responded better to the SSRIs. We know that as a young female, Ms. K does fall into the demographic that has the best outcome with SSRIs. However, we know from her previously taking Topamax that she does not like the pharmaceutical treatment, so it's probably best that we look at her other options as well, which brings us to vestibular rehabilitation. In this study conducted by Eldoen et al in 2021, they examined the effectiveness of vestibular rehabilitation on patients with 3PD. The participants were provided with six weeks of online vestibular rehabilitation. They were told to do daily exercises and they provided a before and after of their symptoms via the Vertigo Symptom Score.

After the vestibular rehabilitation, the average VSS score dropped by 6.9 points and the participant stated that the web-based vestibular rehabilitation was accessible, easily understandable, and effective. In applying this to Ms. K, we know that vestibular rehabilitation may be a treatment option that does not rely on pharmaceuticals and is

still effective. And finally, what about looking at a multimodal treatment? Vestibular rehabilitation and SSRIs have found to provide benefit to patients with 3PD each in their own way, one by affecting the anxiety and one by affecting the vestibular component. When used together a synergistic effect happens that helps improve quality of life. In application to Ms. K, we could look at doing a multimodal approach by giving her a low dose of SSRIs, hopefully decreasing those negative side effects that she experienced previously, and then also providing her with vestibular rehabilitation to work on some of those dizzy symptoms she was experiencing as well.

So what are our takeaways for Ms. K? It's really important to look at the patient's symptoms and take not known that Ms. K had daily dizziness that lasted more than three months, or that she had an emotional component to her case. They may not have known where to go with her, as there was no other disorder really popping out about what was happening with her. And then it's also important to acquire as much knowledge as we can about disorders that have recently been defined. I know our field is ever changing, and 3PD had been talked about in literature. However, it did not have its own diagnostic criteria until recently. And then it's important to consider a dual diagnosis when appropriate.

In the case of Ms. K, she had both vestibular migraines and possible 3PD, so in treating both of those, we may give her best outcomes. And then it's also just important to think about all the treatment options when making a plan and take the patient's needs into consideration. All right, here are my references. Thank you.

- [Dr. Whitelaw] Thank you, Hailey. I think that was a great overview of the role of audiologists in looking at vestibular issues and how, as you mentioned at the very beginning, that the neurotologists rely on the information that we provide as audiologists, so looking at that interprofessional practice again. And hopefully in Ms. K's case, it would give a really great opportunity for her to gain some improvement in

recovery based on the research that you've presented. Next, I have the pleasure to present Teddy Bowman. Teddy is currently a fourth year AUD student at the Ohio State University, and is doing her fourth year at ProMedica in Toledo, Ohio. And Teddy is gonna talk with us about something she's had considerable interest in since she began the program at Ohio State, which is mental health issues in adolescents who have hearing loss. So I'll turn it over to Teddy.

- Thanks, Dr. Whitelaw. I'm so excited to talk to you all today about something I'm super passionate about. So my presentation is titled, Considerations in audiologic intervention for adolescents. So just a little outline of my case, I'll talk about an introduction of our patient that we'll be talking about. I'll give a case history with some of the test results, treatment recommendations, and her outcomes over time, looking at the relationship between mental health and hearing loss and supporting literature. And then I'll do a conclusion and just some key takeaways. Okay, so an introduction to our patient. This is AN. She's a 16-year-old female who has bilateral sensorineural hearing loss. Her hearing loss has been pretty stable for over the past 10 years, and her hearing loss is pretty mild interweaving with normal hearing.

Just a caveat, her bone conduction thresholds aren't in this picture because this audiogram was taken at an annual appointment. So her hearing loss is sensorineural. And for her initial diagnosis, she was diagnosed with bilateral sensorineural hearing loss in 2012 when she was six after failing a hearing screening at her pediatrician's office. She was then referred to get a full hearing evaluation to rule out hearing loss. There wasn't any previous concern about her hearing because she responded to her parents at home, she was doing okay in school, had age-appropriate speech and language development, and never had any ear infections. So she was referred to get that full evaluation to rule out hearing loss. And here are her initial evaluation results.

So it looks pretty similar from that most recent audiogram that I showed before. She had normal tymps, hearing within normal limits except for mild/moderate mid frequency notched sensorineural hearing loss in the left between 1,500 and 4,000 hertz, and further right, but with that mild notch at 500 hertz and mild bordering moderate notched sensorineural hearing loss at 3-4,000 hertz. Her word recognition was great in quiet, 100% presented at 40 and 50 decibels, but when noise was added, there was obviously much more difficulty, 87% at plus five and 73% at zero dB signal to noise ratio. So this was done to help illustrate how she may struggle to hear accurately when in those more challenging listening environments. So the recommendations that were made at this time, first informational counseling was given to explain her hearing loss.

They really emphasized how even though the hearing loss is mild, it's still educationally and communicatively significant. The audiologist explained that her hearing sensitivity allows her to hear the presence of spoken information in most situations, but likely won't support clear access to all speech sounds within words, especially in those complex listening settings like classrooms. And because of this, listening accommodations and a formal education plan were recommended to improve the access to spoken information. So the first main recommendation was to consult with otolaryngology because of that new ID of sensorineural hearing loss, and a CT scan was recommended to look for any congenital malformation, including EBA. It was also recommended to consider genetic testing because of a family history of hearing loss, and it was also recommended to have her hearing monitored every three to four months over the next year to ensure that a loss doesn't change or progress.

And of course, it was recommended to use hearing protection when in noise and limit noise exposure. So a little treatment timeline. She was medically cleared for behind the ear hearing aids and was fit a few months later in November, 2012. So she was in first grade at this point. Consistent use was always emphasized and the acclimatization process was explained. Listening accommodations were implemented, including FM

system, preferential seating, et cetera. And academic improvement was noted. At the start of second grade, a 504 plan was implemented. She kept on using that FM system and consistently used the hearing aids, still was improving academically. Her hearing was also remaining stable over this time, to note. And between fifth and sixth grade is when some changes were starting to be noticed.

So she was more concerned about the appearance of her hearing aids. She didn't like wearing them at school and around friends. She expressed she didn't like being different. She was fit with receiver in the canal hearing aids at this point, and the importance of consistent use was emphasized. And she expressed that they were helping her academically, her mom expressed this as well, but there was just still that component that she didn't want to wear them. So she's now in high school, and this is where we really start to see even more concerns. She started high school in August of 2020 at a boarding school to further pursue her sport. At the start of high school, she got brand new hearing aids, highest level technology, to support her in those difficult listening environments.

And over that course of time since she started high school, she had lost them many times, expressed that she forgets to transfer her Roger between classes. She expressed that she didn't want to wear the hearing aids or was forgetting to wear them because they weren't helping her. Even with that newest level and highest level of technology, she said it doesn't make a difference. So because of this, an R-SPIN speech and noise test was done in aided versus unaided conditions at plus four dB SNR to see if the hearing aids were giving benefit in those complex situations. As you can see, there was benefit seen. Unaided high predictability sentences were 92%, low predictability 67, and aided they were both at 100%.

So they had a good discussion about the importance of using them and how it was demonstrated that they do have the ability to help in those difficult listening

environments that she's struggling in, and the importance of consistent use helping academically, et cetera. So although our patient was saying she didn't receive benefit, we talked to mom as well and she was discussing how there was a noticeable difference in how she was performing with versus without her hearing aids compared to middle school. Her grades are now poorer. And although she has a 504 plan at the school, she does have to be independent with her hearing aids. She's in charge of wearing them, in charge of her Roger. And also there's that component of boarding school.

She's not going home after school, so she doesn't have her parents to keep her in charge of her hearing aids. So moving forward to October of last year, the concerns mentioned before were persisting and there was more awareness of those mental health concerns. A discussion was had with her mom about how she believes her daughter didn't wanna wear the hearing aids at her new school so that she doesn't have to feel different. But in turn, she feels that it's really hindering her relationships and academics. They both discussed how they feel her hearing loss is contributing to symptoms of anxiety and depression, as it causes her to isolate, feel anxious when entering situations where she knows she won't be able to communicate well.

And by not wearing the hearing aids in class, it causes her to miss instruction from the teacher, whether it be information, an assignment given, et cetera, which in turn causes her grades to drop. And then anxiety occurs about that. The patient expressed that she really doesn't wanna wear the hearing aids and use the Roger, and the school is really leaving it up to her regarding what she feels best, what she wants to do. If she doesn't want to use her hearing aids or use her Roger, she doesn't have to. Some things that her mom said that really stood out to me was talking about how the interplay of her hearing loss and anxiety symptoms is leading her to a complete spiral.

She's a hurting teen at the moment, and she's just not sure where to start addressing her mental health concerns. So onto some literature about this. So I know like a lot of our presentations have been regarding, you know, medical audiology and physical health, but there's also a component of mental health. And I feel that this is super important to talk about. So looking at how hearing loss can impact mental health, especially in those pediatric child and adolescent patients, so in general, in the general pediatric population, mental health problems are actually surpassing physical health problems. They affect about one in five children. And what's concerning is that children and adolescents who have hearing loss are at even higher of a risk when compared to their typical hearing peers.

One study revealed that about 15-31% of participants with hearing loss had a lifetime prevalence of anxiety compared to about 9% in their typical hearing peers. And about 26% of participants with hearing loss had a lifetime prevalence of depression compared to 3% of typical hearing peers. Another study revealed that 32.6% of participants who had hearing loss had a current mental health diagnosis and 45% had a lifetime diagnosis, which was actually, interestingly enough, unrelated to the degree of hearing loss. And this really ties into our case because our patient has a mild hearing loss. There's a lot of research supporting that psychosocial impact of hearing loss, and it's not always correlated with higher severities of hearing loss. So even though we know that there are effective treatment methods for hearing loss, a child's quality of life can still be affected socially, emotionally, and behaviorally, so the concern of poor mental health in this population is rising because of these impacts.

So one study I'd like to dive a little bit deeper into is a study done by Cejas et al in 2020 titled, "Prevalence of Anxiety and Depression in Adolescents with Hearing Loss." The purpose was to develop and implement a screening protocol for depression and anxiety for adolescent patients in otologic and audiologic care, with the goal of this becoming the standard of care. And this study was done because mental health

disorders, again, are seen to have a higher prevalence in those with chronic conditions or disabilities like hearing loss. But there's a general lack of research. In general, findings suggest that in this population there's an increase in symptoms like sadness, worry, social withdrawal, et cetera. The Academy of Pediatrics recommends regular screenings for depression, and AAA states that counseling for social-emotional support should be a part of audiologic care.

But universal screening protocols for depression and anxiety have not been widely adopted. Mental health screening is important in general, and it's not in routine primary care unless you bring up a concern. And about 50% of mental health disorders begin by age 14, so it's important that if you work with this population, it's identified as soon as possible. This study gave 92 adolescents screeners, so adolescents with hearing loss in that practice, screeners for anxiety and depression at their annual appointments. They used the GAD-7 for anxiety and the PHQ-8 for depression. If you're not familiar with those, you can look them up online. They're just screeners for anxiety and depression. And a record review was completed to determine the type and severity of their hearing losses as well as what devices they were using.

So if the patient scored above the clinical cutoff, a discussion was had with the adolescent and the parent. So looking at the results, about 25% of the adolescents scored above the clinical cutoff on at least one screener, and 9% scored above the cutoff on both screeners. 30% were at risk for depression and 21% were at risk for anxiety. So if you think about it, nearly half of the adolescents at the practice needed further monitoring or support for symptoms of depression and 37% for anxiety. There was a significant correlation between age and depression score, suggesting that older adolescents reported more depressive symptoms, but age was not correlated to those anxiety symptom scores. Adolescents who scored above the cutoff on the PHQ-8 had bilateral sensorineural hearing loss, and this population reported more symptoms of anxiety as well.

Regarding degree of hearing loss, the majority scored above the cutoff for the PHQ-8 had severe to profound hearing loss. And this is similar to the GAD-7, except second in line were actually those with mild to moderate hearing losses. Regarding the type of hearing device, there weren't significant differences between adolescents who scored above the cutoff on either test by the type of hearing device, so hearing aids or cochlear implants. So how does this... Oops, wrong one. So how does this relate to our case? So we know that both the patient and her mom have concerns for her mental health. They've been seeing symptoms of depression and anxiety and don't know what to do. A screener is a great way to start, and we can measure these concerns directly from the patient's perspective.

Screeners like these are so easy to implement, and learning how to use them is really easy as well. You can give them out with case history information and do them. They take about five minutes. So a big question that is raised when talking about the screeners is, is this in our scope of practice? And the answer is yes. ASHA specifically states that the audiologist scope includes the use of screening measures of mental health to assist with detection, treatment, and referring for mental health concerns. So on the topic of mental health concerns and referring, it's important to have a good relationship with our local mental health professionals so that we can have a referral source. Identifying mental health concerns is so important because of that complex relationship between hearing loss and mental health.

Not only can hearing loss put our patients at higher risk for developing mental health disorders, but it can affect treatment outcomes. Mental health disorders can affect everyday life, simple tasks, everyday tasks. So that's just something to think about the next time you're seeing your patients and looking at their hearing aid use. So getting back to the patient, say they were to score above the clinical cutoff and we used a screener on her. Obviously, the next step is to refer, but we should also think about

what we can do as the audiologist and what resources that we can provide. So as we talked about, personal adjustment counseling is on our scope of practice and it might not be everyone's cup of tea, but if you're working with this population, I think we should do our due diligence to learn some strategies.

So really quickly before I kind of wrap up on the topic of personal adjustment counseling, this was a really great study done by Elkayam and English in 2003, and it just looks at how different strategies that we can use to counsel adolescents with hearing loss. So we do informational counseling daily, but again, we can do personal adjustment counseling, and a lot of us don't know where to start with that. This type of counseling is especially important for our adolescents because they're going through that huge transitional stage. This in an of itself is a lot, but adding hearing loss into the mix adds a lot more complexity. But it can be daunting for us as the audiologist to bring up these, you know, this type of counseling.

So we know that talking to adolescents is a bit hard. They can give one word answers, not wanna talk to us, open up. But there are so many tools that we can use to help us with this. For example, like in this study, they used questionnaires as a basis for counseling and to help facilitate things to talk about. So looking at the results, common themes that were seen in the counseling sessions were how hearing loss can be isolating, identity and self-concept, cosmetics and other hearing aid issues, and self-acceptance. There was a follow-up questionnaire that measured the extent to which new information was learned, how behavior had or would change, self-perceptions changed, counseling sessions were beneficial, and additional opportunities for discussion, how these things would be helpful on a scale of one to five.

And a lot of them ranked super highly on the questions, and so 80% ranked themselves a four or five on a scale of five on at least one question and 10 ranked

themselves as a four or a five on a scale of five on more than two questions. And eight out of 15 said that it was really helpful to talk about their hearing loss. So that's another thing to think about. Maybe support groups for this population, or making it a point to do some personal adjustment counseling. So to relate to the case, our patient talked about how they were a bit apprehensive about wearing their hearing aids, not wearing them consistently. They thought that the social and emotional cost wasn't worth the benefit.

And I thought about her through reading this study, how she wore them and not wearing them around friends, really struggling with her anxiety, but she knows she has trouble communicating. And it's a little bit frustrating because, you know, you keep seeing discussed importance of regular hearing aid use, but we kinda need to dig deeper for that root cause of why aren't they wearing their hearing aids? What's really going on? So we can do this using our counseling skills. So next step for her, she might be moving to another school that already has children with hearing impairment and cochlear implants and other learning differences, which would be a great inclusive environment for her. But also the Ohio Parent Mentor Program, it was developed to assist families who feel like their school is not in compliance with IEP or 504 plans, or need help developing a plan and really figuring out that root cause of inconsistent use and trying to have that conversation about motivation to wear them.

She just needs more support in general, and she should learn advocacy skills, et cetera. And then in the future, getting a mental health evaluation since they have those concerns. And like I kind of talked about before, it'd be interesting to do that screening on her to see what those results would be. So overall improving that mental health and of course audiologic intervention. So some key points and final thoughts very quickly. Mental health concerns, again, are surpassing those physical health concerns, and the children and adolescents we work with with hearing loss are at even higher risk. So just kind of always keeping that in mind. Relating this to the case, we sometimes need to

think further and dig deeper for that root cause if we're seeing our patients being inconsistent with their hearing aid use.

And even when we have a patient with mild hearing loss, we should still be thinking about their mental health and how they're impacted. Again, many studies support that severity of hearing loss isn't directly correlated with severity of psychological symptoms. And it should always be remembered that mild hearing loss doesn't necessarily mean mild impact. A five minute mental health screener can help us support early intervention, treatment adherence, and overall improved quality of life. And that's our main goal. A big concern is that we don't know how to begin addressing patient mental health, so we really need more training with mental health education, common psychological disorders related to hearing loss, and use of those screeners. We do have a role in our patient's mental health and we should utilize that.

So again, having that good rapport with mental health professionals. It'd be even helpful to take it a step further to discuss with mental health professionals about psychosocial impacts of hearing loss and tying together that interdisciplinary care. But we know that there's a shortage of mental health services, but we can provide some counseling for our patients to an extent. Just informational counseling won't necessarily give us successful rehabilitation outcomes. Our patients need that personal support, especially adolescents as they're such a transitional stage of life. I hope through this discussion you've learned a lot more about mental health and what the audiologist's role is and start to think about how you can begin to implement this information with your patients. And there's my references. Please don't hesitate to contact me with any questions you have either.

- [Dr. Whitelaw] Thank you, Teddy. Teddy actually did put this into effect this year in educating some mental health professionals through our program and building that partnership. And as she pointed out, boy do we need some of those resources. And

the fact of the matter is that anything we can do to maybe encourage mental health professionals to work with the kids that we work with, such as using a screener and giving evidence, is really helpful. I'm gonna wrap up with my short quick case, but this is a very different approach to ototoxicity than what Breanna presented. Oftentimes I think we as audiologists think about chemotherapy, and I want us to start thinking about what our role might be in a larger perspective.

And I wanna talk about thyroid eye disease as part of this. And as I'm looking at these pictures, I'm thinking, "Boy, am I glad I work with ears and not eyes on a regular basis." But thyroid eye disease, you may have seen this because it's very popular right now. If you turn on any network TV channel, there's always information about thyroid eye disease or TED. And it's a condition where your immune system mistakenly attacks the muscles and the fat tissue behind the eye. And what you'll often see on the TV commercials is they'll talk about bulging eyes or redness and swelling. And these are folks who have significant issues that often keep sunglasses on indoors. The risk factors for thyroid eye disease include genetics and family history, gender, so women are at higher risk than men, people who are cigarette smokers, and people who've had treatment with radioactive iodine, which is often true in thyroid diseases.

It's relatively rare and has an incidence rate of about 19 per 100,000 people per year. And the symptoms I've already mentioned. One of the things that people talk about a lot with this, though, is strabismus where the eyes don't coordinate or are misaligned and it's very, very difficult for quality of life issues, and they will have eye pain, redness, and swelling and often not even realize that it's related to their thyroid. Okay, well, I'm gonna try to make this move ahead. There we go. The medication that's used to treat thyroid eye disease that's most common now is called Tepezza. It's an infusion treatment, and the typical side effects are those of infusions. You might get some swelling at the infusion site or a little bit pain.

And each treatment is noted to be thousands of dollars. Usually people who are treated with Tepezza have three to four infusions to treat them. It reduces or improves the symptoms of thyroid eye disease, and we already know what they include, and it's heavily advertised both on social media and on television. So how does Tepezza apply to patients who might see an audiologist? It raises some questions for us. We know, and I've said this now 15 times since we've started, that audiology is part of an interdisciplinary practice team or IPP for people who have potential ototoxic treatments beyond what we might think is the usual suspects. As I mentioned, chemotherapy for cancer. Educating physicians to treatment side effects is really important prior to treatment, and pre-treatment audiologic assessment is always indicated for someone who may be using an ototoxic medication.

And then as Breanna so eloquently pointed out to us that ongoing monitoring, even after treatment is concluded, is necessary, and thinking about how do we get physicians to take this seriously. So my patient is a 53-year-old man who happens to be an optometrist, and he waited more than a year to have insurance approve his infusion of Tepezza for his thyroid eye disease. And he really had done a lot of research on this, and the cost he reported was $12,000 for the first infusion. Prior to the first infusion, the risks and side effects were discussed with him, but at no time was he told about something that's very commonly noted now in the literature, which is the potential for permanent hearing loss and/or tinnitus as possible side effects.

Dr. N had a positive history of tinnitus as his father had tinnitus that was described as significant at a very young age when he was a relatively young man, and Dr. N saw the impact that this had on his father and his family. He had an audiologic evaluation several years ago when he had mastoid pain, and it was found to be related to muscle spasms in his neck and it resolved. And at that point in time, he was told that he had normal peripheral hearing acuity and had no issues with tinnitus. Five to seven days

after his first infusion with Tepezza, he reported that he had constant bilateral tinnitus that was described as ringing, and he reported oral fullness.

Then he started to investigate the current reports on side effects for Tepezza and he found out this information about both hearing loss and tinnitus. He had an audiologic evaluation, so he completed the THI. He had an audiologic evaluation about two weeks after the tinnitus started, which was three weeks following his first infusion. He reported oral fullness, as I mentioned earlier. And the goal for this appointment was a baseline, although he recognized it would have been best done before his first infusion. It was... I'm sorry, guys, I don't know why this computer keeps jumping for me. An audiologic evaluation was completed in March, 2023, and it revealed normal hearing acuity, which was very normal, seven dB HL for the right ear, three dB HL for the left ear of pure-tone averages.

We did extended high frequency testing and it revealed a mild hearing loss through 12,500 bilaterally. His SRTs were in agreement with his pure-tone results. His word recognition was excellent. And he also demonstrated excellent word recognition for speech and noise performance using the QSIN. Tinnitus pitch match was 4,000 hertz, and he had a 16 dB SL tinnitus loudness perception. And in case you're not familiar with doing tinnitus testing, that is pretty significant. Based on this, he opted to discontinue the Tepezza treatment, which is generally three to four infusions, and he wanted to talk with his ophthalmologist about letting other patients know about getting a baseline before they start the Tepezza, particularly since it's not always urgent, like say a chemotherapy might be.

Most people have some time to get this done. His ophthalmologist reported that he was not particularly concerned about this report or anything in the literature and indicated that the ringing would just go away. So here we are, the takeaways. Update is I was just in contact with this patient this week, and his tinnitus has not gone away.

It's persistent and has moved from the acute phase of less than three months to now having chronic tinnitus. His THI has gone down significantly, and he's learned to minimize his perception of tinnitus. He's advocating for audiologic assessment prior to implementing Tepezza treatment for thyroid eye disease. And in case you haven't seen this on television or read it on social media, there's now a class action lawsuit related to Tepezza treatment and it's looking at people who have permanent hearing loss, which is a significant number, and also persistent tinnitus.

And so the audiologist's role in this is really critical and we have to get with ophthalmologists to talk with them about that. And also looking at our broader view of ototoxicity. So I hope you think that case is timely and interesting, and even though thyroid eye disease isn't highly prevalent in the population that we might see, it's highly advertised for on television and gives us an opportunity to assure that we're helping these patients prevent issues or monitor issues with the possibility of having an infusion treatment that is ototoxic.

I'd like to say that we've got maybe a few minutes for questions, and I wanna get to the questions that were raised. But if you have questions for any of us, our emails are here, and don't hesitate. Everyone is happy to talk with you, so please feel free to contact any of us. But I wanted to moderate two questions that were specifically for Hailey. Hailey, the first question is related to 3PD and VNG results. So, "Do you see 3PD as abnormal VNG results, such as say abnormal OPKs?"

- [Hailey] Yeah, that's a great question. I understand why they brought up OPK because that is a complex visual stimuli, and we know that that can be a trigger for 3PD. However, I am unsure about specific VNG results. I do know that in Ms. K's result, she had all normal VNG testing. And then also I know that the HINT, which is another form of vestibular testing, looks at acute symptoms. So on the HINT 3PD would not show up

because it is a chronic condition and not acute. So hopefully that answers the question.

- Thank you. And there's another question for you, Hailey, from Francis. And it's a question that I'm particularly interested in and ties into what Teddy was talking about. "Is there ongoing research that you're aware of of 3PD in the pediatric population?"

- Yeah, so I know that there was an article written in 2021, let me look, by Wang et al, and it was a retrospective chart review, so it wasn't in the current time, but they were looking at previous pediatric patients' charts to determine if they had the diagnostic criteria met to be diagnosed with 3PD. However, I'm not sure if there's actual current studies happening in the pediatric population with 3PD.

- So it sounds like Wang is a great place to start if Francis wants to look more at that, or anybody else who's on the grand rounds today. I know that we're a little bit over time and I appreciate everybody who tuned in today to hear about these cases. And if you have additional questions, as I said, we'd be happy to talk with you. Thanks to AudiologyOnline for providing such a great forum for this, and we look forward to interacting more in the future. Thank you so much.