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Vestibular Rehabilitation,  
presented in partnership with Salus University  
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Presenter: Anne Hogan, PhD, CCC-A, FAAA  
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- [Christy] At this time, it is my pleasure to introduce Dr. Anne Hogan who will be presenting Vestibular Rehabilitation, presented in partnership with Salus University. Dr. Hogan is an assistant professor in the School of Audiology at Pacific University in Hillsboro, Oregon. After completing her Master's in 2002 from Southwest Missouri State University, she practiced clinically in North Carolina before obtaining her PhD at James Madison. In 2015, Dr. Hogan joined the faculty at Salus, serving as an adjunct assistant professor in their online programs. Her research efforts while at Pacific University have ranged from surveys of clinical and educational practices, to establishing an Interprofessional Balance Clinic, to exploring the use video games for the treatment of vestibular disorders, and now consulting with the NCHS and NHANES for the current Balance Component. Thank you Dr. Hogan for being with us today, and at this time, I hand the mic over to you.

- [Anne] Thank you so much for that kind introduction, and thank you all for being here. As said, I am here as part of your vestibular series through Salus. I'm actually pretty excited to say I'm no longer an assistant professor at Pacific, I actually got to jump my way up to associate professor this summer, became official after all the paperwork had counted. So, and in addition to all the things that Christy said, I also have a WOC appointment for the VA hospital so I can do some collaboration with the National Center for Rehabilitative and Auditory Research. And I am also a wife, a daughter, a sister, a friend, and these are my pups, I'm a doggy mom to Paco and Pepper. Back to the important stuff, vestibular rehabilitation therapy. The aim of this course is to educate you, and I'm assuming that people that are here today are audiologists, and if you're not, that's awesome, glad to have you as well, then we're gonna talk about the principles of vestibular rehabilitation therapy to equip you and immediately guide your dizzy patient on the path to recovery. And so that you know exactly what we're going for today, I'd like to just cover those learning objectives. I want you to understand the goals of each type of vestibular rehabilitation therapy, so you'll be able to state and describe those three types. Because it links to the second one, which is ranking the

predicted outcomes of vestibular rehab by the type and degree of vestibular and balance disorder, because I want to help you with, or help your patients have realistic expectations, and so that you can make appropriate referrals depending on what you find in terms of your dizzy patient. The third goal is to identify one daily task that can be used for the various types of VRT, and what would not be appropriate for VRT. And the reason that I think this is an important learning objective is because it can take weeks or longer to get to a provider of vestibular rehabilitation if you're going through physical therapy, and it is really important to get our patients on that road to recovery as quickly as possible. So if you know some home-based examples that are safe and effective to use, if you can empower your patient to move forward immediately, you're gonna really help them recover more quickly and more fully. The reason I do this and I have these goals and we're really wanting to have you know about vestibular rehab is if we are solely diagnosticians without an understanding of the next steps, I wonder what our utility is. I feel we must look at the whole person, not just that little part of the ear, and provide the proper support so that we can get that patient in that direction forward. So now you know my very lofty goals with this course.

Next question is what is vestibular, and what is V RT or VRT? You'll see it in the literature a few different ways, VRT, V RT. VRT stands for vestibular rehabilitation therapy, V RT is vestibular and balance rehabilitation therapy, and what that is is long-term, movement-based treatment of vestibular disorders with the aims to improve functional outcomes. As audiologists, we don't, our focus is to not focus on the and balance part of VRT, but when we improve vestibular function, we should also improve balance. V RT does not include short-term treatments, such as the canalith repositioning procedure, also known as Epley procedure, or a modified Epley. Medications are not V RT, surgery is not V RT, however, V RT or VRT can be used in combinations with these other treatments to improve overall outcomes. V RT and how I'm presenting it today is based upon the work of Susan Herdman, who's a professor of physical therapy. Most of her work is done at Emory College outside of Atlanta, Georgia, I think, don't quote me on geography things. But Susan Herdman is probably

one of the most published in terms of vestibular rehabilitation therapy. A lot of this presentation also comes from the works from Susan Whitney, who is another amazing vestibular rehabilitation specialist out of University of Pittsburgh, but we're gonna use the Herdman Model because she literally wrote the textbook on vestibular rehabilitation therapy that is commonly used. So the Herdman Model, there are three main types of VRT; Adaptation, habituation, and sensory substitution. So if I were to have you be a student in one of my face-to-face classes, I'd say, you know what? You might want to consider these things as something you might want to remember, so the three main types of VRT are adaptation, habituation, and sensory substitution. And we'll go into more depth on each of these as we move forward. And what does VRT look like? Well, it is a fluid mosaic. It is patient-based, it is function-based, and it's goal-based. The exercises used in VRT, they range from being seated to walking, with movement of the eyes, the head or both. VRT can go from using high-level technology to no technology at all. In my PhD as I was studying this, I would get so frustrated when looking through the literature because there was a lack of uniformity, or even on surveys and studies, there was a lack of description of the exact VRT used.

And as I've grown in my practice and grown in my understanding, a lot of it has to do with this fluid mosaic because VRT needs to be something that is an appropriate goal for your patient in terms of where they are physically, but also where they are in their life. What is interesting to them? What are their personal goals? And so that is why there is so much lack of uniformity often in the literature or some ambiguity in terms of what these VRT exercises are. So if you are doing a little bit more reading on this and you hit that same frustration level, I feel ya, but also please remember that we're trying to be a little bit more individualistic in terms of the treatment for our patients. So where does all of this come from? So the historical perspective is that vestibular rehabilitation therapy comes from these Cawthorne Cooksey exercises. Cawthorne and Cooksey were a couple of otologists, EENTs, in the UK, maybe before it was the UK, back in the 1940s, and they published this in 1943 and 1946, and these were exercises that were provided and were utilized to help treat people who were dizzy. And as we move

forward, you'll notice that these are the basis for modern vestibular rehabilitation, but as you can probably surmise, some of these are not used. So I talked to in the previous slide about how these are exercises in modern VRT that range from being seated to walking with moving eyes, the head or both, and you can see that we have this in bed or sitting with just eye movements, moving to head movements, moving to sitting with eye movements and head movements, shrugging shoulders, circling, bending forward, to picking up objects, but then they get to it a little bit more complex. We've got walking up and down a slope with eyes open and closed, walking up and down steps with eyes open and closed. So as you could imagine whereas these do serve as the basis for modern VRT, we don't tend to use all of these, probably because we've got more active lawyers and we also don't want our subjects to go downstairs with their eyes closed and fall.

So what's happening with vestibular rehab? The general concepts of what happens is we've got neural recalibration of the vestibular input in terms of vestibular mismatch. We've got neural recalibration of sensory weighting of the three main inputs, which are vision, vestibular and somatosensory. We've got the teaching of new skills to compensate for vestibular loss, and please, appreciate that I make errors in my presentation sometimes. All right, so quick flashback, there was a poll that was provided as you came in. How many of you had any distinct vestibular coursework for your audiology education? And there should be a poll that you completed, and you should also answer the question how many of you had, oh good, how many of you had education on the vestibular treatment? So we're talking, again, treatment, which were surgery options, Epley, medication, things like that. Oh yay, thank you guys for filling out my polls. So majority of us, and looking at, and you guys can all see this, is currently the voting, over 90% of us had some distinct focused vestibular coursework, either in your Master's or in your AuD, in your clinical education. But in terms of treatment with surgery, the CRP, or Epley, medication, it looks like maybe 2/3, not quite 2/3 of us had that. And then therapy based, it's 2/3 of us did not. So really looking at majority of us, while we know about vestibular function, we learned a bit

about testing in terms of the treatment and especially the long-term treatment, vestib rehab, this is something that has not been covered in education. So getting back to the presentation that we had, I find that to be true as we go through and we've done some, there we go, oops, too far. If you think back to Dr. Meyer's presentation from last week she presented a survey that she and Robin Criter and I did over the summer just looking at faculty members and recent graduates of AuD program asking about vestibular education. And in terms of vestibular rehabilitation we asked, is teaching or coursework in the vestibular area, vestibular rehabilitation, not just vestibular treatment like Epley or medicine, is it important? And the faculty, 73% said that it was critical or moderately important. 81% of recent grads said that vestibular rehabilitation and having coursework in it is critical or moderately important. And in terms of the number of people who said it was not important, they were 0%. There was a question about specific exercises in terms of vestib rehab, and whether or not that fit that fluid mosaic, not quite, but we'll get to specific exercises, thank you Janine, I will get back to that shortly.

So going back to our poll, are there, so we know it's important, are we doing it? So just like you reported in this poll, 2/3 of you guys said we're not really doing vestib rehab in the coursework. The faculty, interestingly enough, only 13% of faculty said that it's not covered, but recent grads said that, 38% of them said that it's not covered, so we may have some weighting in terms of how many grads do we have from each program? But for 13% of people that are serving in that faculty role to say, "Oh well, it's not covered," but then just now in our polls with everyone that is participating today, we saw that at least 1/3 of you said that the treatment, not necessarily the therapy portion, 1/3 of you said treatment's not covered, and over 2/3 said well, therapy's not really covered. So really going back to it's important, we think it's important, but do we make time for it? Not really. I would like to say that there is a need for it, and I think that not just the data from these polls that we've done but also data in the literature. So looking at the NHANES data, and for those of you that are not familiar with NHANES, NHANES is the National Health and Nutrition Exam Survey. This is the epidemiological study for the

United States, and this is getting all kinds of information not just about balance or hearing, but we're looking at blood work, we're looking at body measures, eating habits, sleeping habits, dental habits, all kinds of really cool stuff is going on, and this is that, this data has been collected for over 60 years. Very cool thing about NHANES, people say, well, what's that? You go to the doctor and you take your kid to the doctor and they say, "Oh, your child's 50th percentile for weight "and 90th percentile for height." Where did they get that data? That comes from these NHANES studies. Well, Yuri Agrawal looked back on some balance data that was collected from 1999 to 2004 and looked at some other information, and in that balance data, they were just looking at postural sway, can someone complete just a modified Romberg in four basic conditions? That data showed that 35% of people over the age of 40 have problems standing in the Romberg position, so meaning they couldn't complete the four conditions of the modified Romberg, so standing, eyes open, eyes closed on a solid, just a normal floor, eyes open, eyes closed on dense foam.

So 35% of people over age 40 couldn't get that. And as people get older, it became more and more difficult. 85% of those over the age of 80 could not complete this, and this is standing for 30 seconds on dense foam, eyes open or eyes closed, after being able to complete standing for 20 seconds, eyes open or eyes closed just on a solid ground. So that's saying okay, first of all, the aging population's having some balance issues. Second, Criter and Honaker, they went into their clinic and said, "Okay, we're not gonna ask our vestibular patients "we're gonna ask our audiology patients, "patients that are coming in "just for hearing related disorders. "How many of you guys have had a fall in the past year?" 68% of them. These are, again, not dizzy patients, these are hearing patients. 68% of patients in the audiology clinic were having falls, whereas non-patient adult, so age-matched adults that were not audiology patients, only 28% of those people reported a fall in the past year. So again, these are our patients, whether or not you're seeing vestibular patients, these are our patients that are dizzy and falling. Over 20 years of looking at the efficacy of vestibular rehabilitation, it is quite obvious, vestibular rehabilitation therapy reduces falls. It reduces falls in

people that have unilateral, that use vestibular disorders, comorbidities of other types of things, so we can look through a whole plethora of different pathologies, but the overarching evidence, vestibular rehabilitation therapy reduces falls. Falls are the leading cause of death and injury from an injury related type of thing in those over 65. Why should this matter? Well, everybody wants to talk about the cost of healthcare. 2016, the CDC said that over 50 billion dollars have been spent on direct medical cost for falls. 50 billion, not million, billion with a B, so that's a pretty high number, and so that is why we should all be interested in this and take knowledge of this, so again, I'm glad you're here. Yeah, for working with an audiology patient, you're probably working with patients for falls risk. All right, so back to VRT, who does it? Audiologists can do VRT. A lot of people say, "But I don't know enough." You're here, you're taking the first step, and I agree, scope of practice, we definitely want to work within our knowledge base, but we want to work within that ability to do what we do best for the patient.

However in those ASHA and AAA's scope of practice documents it does state that audiologists have within their scope of practice to treat vestibular disorders, and vestibular rehabilitation is the best treatment for vestibular disorders for a majority of them. Physical therapists are going to be your main providers of VRT, and that's because it's built into their billing structure, and that's also because they are pairing it often with that vestibular and balance rehabilitation therapy. They are doing a lot of that lower limb type of exercises, those core strength type things that really aren't in our education or scope to really know that well, so physical therapists are going to be the main providers, but they're not the only ones. Occupational therapists have it within their scope of practice to treat vestibular disorders. So if they are trained and comfortable in it, then they should do it. I'd like to note that physical therapists, while they do have it within their scope of practice, being a provider of vestibular rehabilitation is extra training beyond their DPT. So if you say, "Well I didn't learn about this "during my AuD," neither do all of the PTs or the OTs, they have to go on and get extra training in this in order to be a competent provider. Optometrists actually do some of the vestibular rehab therapy, more on that oculomotor end of thing. So if the



eyes aren't working properly, the vestibulo-ocular reflex isn't going to work properly. So our optometrists, especially those that are trained in vision therapy are going to be a nice feature, a nice provider that we can work with and pair with so that we are providing the best type of outcomes for our patients. Of course, we're also going to have patients that do non-prescribed classes. So we'll have patients that may just take Tai Chi and they say, "Well I'm doing vestibular rehab, "I'm taking Tai Chi." There are Tai Chi for balance classes, but basic Tai Chi also may be something that's being done. They might say, "Oh well I'm working on my balance "by doing yoga." Sometimes the local gym will have balance-focused training just led by a personal trainer. Sometimes the physical therapist will actually prescribe this, but sometimes it's just led by your local physical trainer, or just a local gym instructor. And then of course we've got our lovely internet, so we've got a lot of exercises that are out there on the internet that our patients might be turning to. And I'm not saying any of these are wrong, but I think it's important to kind of wrap our brain around the whole, if we think about vestibular rehab and where our patients are getting it, it's not going to be one area, it's multiple areas that they're going to see that.

All right. So who benefits from vestibular rehabilitation therapy? Well, the patients that are going to see the most benefit from VRT are going to be those with a stable, unilateral vestibular injury. And so some examples of this are gonna be vestibular neuritis or labyrinthitis, that one-time occurrence. It changes the firing rate on one side permanently. It stays at that rate, it does not fluctuate, doesn't happen multiple times, just a once and done. And then they're able to move forward with that compensation. Those who are going to have the least benefit are going to be those with a fluctuating pathology, especially a fluctuating central pathology. And some examples of that are going to be someone with multiple sclerosis or with Alzheimer's disease. So let's see how we can kind of rank these thinking about the different pathologies we have. So thinking back to that who benefits most and least, in your head, who do you think's gonna be first? So we've got a transient ischemic attack, so a mini-stroke happening once, we've got superior semicircular canal dehiscence, we've got neuritis, and we've

got autoimmune disease. So let's see, which one comes up first? Vestibular neuritis. A patient with just a vestibular disorder, it's gonna happen once, not affected by a central pathology, they're gonna have your best outcomes. Well, who's gonna be next? Again, that's stable, they've had a TIA happen once, if it's stable, they're going to be the next most benefited by VRT. Dehiscence, they're gonna see some benefit, but we have, with semicircular canal dehiscence, we've got fluctuations in the system because of that, oh, that third window effect. So if it's an untreated dehiscence, meaning we haven't had surgery or anything, we're just trying to live with it, they'll see some benefit from VRT, but they're going to see very limited benefit. And again, someone who has a fluctuating central pathology such as an autoimmune disease, we may see benefit, but it will be limited because of that fluctuating system. So why would a fluctuating system be more difficult to see benefit? The analogy I like to give for this is for your car. Say you've got the check engine light that comes on, but it doesn't come on all the time, and so you take your car to the mechanic, our brains being the mechanic, and if the check engine light is only coming and going, the mechanic can't use their computer to figure out A, where that erroneous signal is coming from, so then B, they can compensate for it.

Our brain is like the mechanic, and a fluctuating system is like that check engine light that comes off and on and off and on. We don't have a clear signal as to what's going on in terms of what's wrong, then the brain can't do its thing, do its magic for lack of, for the fact that we don't have tons of time, I'm gonna stick with it does its magic, it doesn't have the opportunity to actually recalibrate. And so that is why those fluctuating central or peripheral pathologies have the hardest time in terms of benefit from VRT. Hopefully that makes sense. Poor compliance is actually going to be the worst outcome from VRT. So poor compliance is worst outcome of all, meaning they're just not using it. Let's think back to our hearing aids patients. What hearing aid patient is gonna do the best with their hearing aids? It's gonna be the hearing aid patient who actually wears their hearing aids. If you think about vestibular rehab as wearing hearing aids everyday, it's the same kind of thing. Your patient who doesn't do their vestibular

rehab is going to have the worst outcome. And as we've said before, patients with fluctuating pathologies will see some benefit, it just will be limited. There are other factors to consider with VRT. There are psychological factors that we must consider when we're considering this VRT. Anxiety, depression, and high levels of stress are definitely areas where those central type of things, and we're considering them central because they're not the ear, those can impact a person's ability to recover from a vestibular injury. Anxiety, depression and stress all release neurochemicals into the brain, and those neurochemicals actually block the neuro receptors at the level of the vestibular nuclei, making it so that the brain does not have that opportunity to recalibrate. What's a great example of this? How many people get a little off balance or dizzy when they get anxious, or high levels of stress. That can definitely be something we see there.

So if we have a patient who comes in with a vestibular neuritis, but they are also dealing with anxiety or depression, as evidenced in maybe a HADS scale, we need to address the psychological components that are very real. If I were spinning for a few days straight, I'd probably get some anxiety, or some depression going with it, if I felt like my life was over because I could no longer turn cartwheels in the front yard, and yes I still turn cartwheels as much as I can, cartwheels over 40 are the way to go, but if I couldn't turn cartwheels anymore or climb trees or swim laps or be as active as I am, I would probably get depressed, and so I would need to have those aspects addressed in addition to the physical portion so that I can have full recovery. There are central comorbidities that are paired with vestibular disorders that can make it so that we have poor outcomes. Migraine, untreated migraine especially. Of course, migraine is something that we're still trying to figure out what it is, but if you look at Balaban and the research he's done looking at serotonin and the aspects of serotonin and the fluctuations of serotonin that may or may not be why we get some of these migraines, migraine is just basically a fluctuating central pathology. And so what you have is an untreated fluctuating central pathology that's underlying some of these peripheral pathologies, making it difficult to actually compensate. If there's untreated visual loss,

as we are talking about these exercises, we're gonna talk about the need to engage the vision, the visual system and using vision in part of these exercises, and if you have someone who needs glasses and doesn't use them, if you have someone who wears the wrong prescription, those people are going to have greater difficulty actually recalibrating a vestibulo-ocular reflex because we need visual input. If there are oculomotor abnormalities because of an injury to the eye or essential type of injury or because of essential pathology that has attacked the oculomotor neuron, that can also impact that patient's ability to reach maximum recovery.

Poor overall health is another factor. When we talk about audiological terms, a big term that's thrown out is cognitive load, we think about cognitive load and how our patients with hearing loss, once we fit them with hearing aids, we're reducing cognitive load, beautiful. But, cognitive load doesn't just have to deal with hearing, it deals with everything we do in terms of processing, and our cognitive load for making our vestibular system start to recalibrate and make us feel better after some vestibular loss or some dizziness, if our cognitive load, our energy is being used because we're sick, because someone maybe has a systemic illness that they're trying to fight, maybe they have cancer, maybe they have just a really bad cold that's affected them, that's going to make it so that they are going to have more difficulty compensating, or the compensation that they have will step back a few steps because their cognitive load, which is working really hard to rebalance the system is now being pulled away to deal with other things, and that also happens in levels of high stress. Just things to consider with our patient, we have to look at them as a whole person, we have to look at them with the eyes of a provider of overall healthcare and not just I'm looking at your ear, and we have to look at them as a member of an interprofessional team or a multidisciplinary team because as you're trying to get through this, I'm sure you're figuring, huh, there's a lot of stuff where we need to call in other professionals, and I completely agree. Still hoping you have a little bit more than that when we get done with this. All right, so what do we have so far? VRT, what is it? It's a long-term intervention to improve vestibular and balance function. Who does it? Audiologists do

it, primarily physical therapists, occupational therapists, optometry. Who benefits? Most is a stable vestibular injury, least is a fluctuating non-vestibular balance insult. And we need to treat other confounding pathologies first for best VRT outcomes. Hopefully this summary slide will be helpful as we're moving things forward. All right, let's get down to the nitty-gritty, what is VRT? Well there, again, as I mentioned before, are three areas of VRT; Adaptation, which is sometimes called gaze stabilization, habituation, and sensory substitution. This picture contains my niece in her little gymnastics performance in her village in northern Netherlands. She's the cute one there on the far right. Not expecting our patients to get to these levels, but for wanting to have good balance, for wanting them to have the ability to tumble if they want to, turn cartwheels in their front yard if they're just that crazy. We're gonna start talking about vestibular rehab with adaptation. Adaptation, which is sometimes known as gaze stabilization, focuses on improving vision in dynamic conditions. Adaptation is focusing on improving the vestibulo-ocular reflex. Information from the nodulus of the cerebellum provides feedback to the vestibular nuclei, adjusting the firing rate.

So when we think about adaptation, we're thinking VOR, we're using vision, and we're trying to improve that vision clarity with dynamic conditions, AKA, while the person is moving. So what are some examples of these exercises? Well first of all, there's different levels. If we go back to those Cawthorne Cooksey exercises and they talked about in bed and seated and they moved up, they kind of followed a nice hierarchy, went from really simple to much more difficult. So VOR adaptation exercises, a level one is going to be the most simple. So the task for a level one exercise is to focus on a stationary target with head movements. So they're reading it, it doesn't have to be a passage, it can just be a word, something where they're looking at it trying to keep it clear, and these exercises are to increase speed as the ability increases. And so this image here on the bottom left, you'll see that Dr. Hain has this on his website, it's a great website if you want some information, very thorough, he has his residence updated all the time, this talks about some VRT. So you have a person holding a business card, and a business card would imply there's writing on it, and they look

straight ahead, turn their head to the right and turn their head to the left, and as you can see in the image, this person is keeping their eyes focused on that image in front of them, that business card. And you're going to have your patient to do this in multiple conditions, horizontal, vertical, and then you'll start seated, standing, and then walking. And we're going to look at a video now of a gentleman doing these exercises. This is my dad from a few years ago, and he's holding a business card and looking at the business card, he's supposed to be holding it steady, kind of difficult, and just looking at the business card while he is moving his head back and forth, keeping his vision clear, and shaking his head back and forth as he does that. And then he's going to move his head up and down, nice and vertical VOR, starting slow and then speeding up as he gets more comfortable with it.

All right, so back to our PowerPoint, so that is an example of a seated VOR level one exercise. So Janine asked earlier that the clinic that she's in has, their vestibular PT, first of all, awesome, two thumbs-up, you have a vestibular PT, that has patients walking down the hall turn their head to left to right while walking, and is this what I mean by fluid mosaic? What you've described is potentially an assessment that your PT is doing, part of the dynamic gait index, or if this is part of the exercise rehab, depends if the person is looking at things and trying to keep them clear while moving the head left to right, then this could be a level one type of exercise. Fluid mosaic means that it is the amount of exercise, the type of exercise, the level of the exercise changes with the patient's level of ability. So for example, if I have a patient who can't read, which happens more often than I would have expected, but I definitely have patients who just can't read, I wouldn't want them to look at a business card and try to read because that's just going to be a little rude for me to say, "Well, you can't read, "but I want you to read." I would give them something where I would say, "Okay, here's a picture, and as you move your head, "the picture might get a little blurry, but that's okay. "We're going to have you move your head side to side, "just gently for a few seconds, looking at that. "And then move your head up and down gently "looking at that picture." So that's part of that fluid mosaic, it's adapting the exercises for the

patient. And Janine's example where the person is walking down the hall, this is someone who is at a higher level of recovery because their VOR is strong enough and their vestibulospinal reflexes are strong enough that they're able to do this walking safely. Most important thing while doing and prescribing exercises is that your patient is safe, so that's why we really do start in the seated condition. Make sure you're in a chair, I know my dad's sitting on the edge of the bed here, so not necessarily the best chair, but it was the room in the house that had the best lighting. So seated, making sure they're going to be nice and safe as they start this. When they move to standing, you want to make sure they're next to a chair where they can hang on to that chair if they need to, and/or standing in a corner, so if you can have that patient have a corner where there's nothing that's behind them and have them stand so that if they start to fall, they just fall backwards into the corner and have a steady chair in front of them, you're gonna make sure that they're much more safe with these things as standing. When we get to the walking aspect, they should be able to do the exercises at multiple speeds or frequencies both seated and standing before we move to the walking exercises.

So Janine, I hope that answers your question. All right, so then as we have gone from moving our head while we have the vision clear, now this is kind of a level 1.5 'cause we're going to throw in some moving visual targets with the head stable, so these are more of an oculomotor exercises. These are going to look a lot like our testing of saccades and smooth pursuit, and just like with our level one VOR exercises, we're gonna want our patient to have the speed increase as the ability increases. And you want to have the patient do this both seated and standing, in both the horizontal and vertical conditions. In your handout, there is actually a YouTube link, this is my YouTube video, you are welcome to use it as you like, but we're gonna take a look at that video right now for the oculomotor exercises. So keeping the head still, you're gonna try to find each number as it appears on the screen just moving your eyes, so you can do this with us. So for this, someone would need to know their numbers, but they're able to follow these with their eyes as they move forward. So we're just kind of

keeping our head still, finding the numbers as they pop up, so these are saccades across multiple areas. Now we're gonna do more of a smooth pursuit type of task, you're gonna use your eyes to follow each truck as it moves across the screen. First set will be a little bit slower, second set will be slightly more quickly. I used a simple recorder, Screencast-O-Matic is a free recorder, and an animated PowerPoint to create these videos. These are easy to create, make 'em yourself, upload to YouTube, and again, we're just following the trucks with our eyes. They're not quite as smooth as I'd like 'em to be, but that's PowerPoint sometimes. Very simple, so now you have the idea of these 1.5 exercises. All right, and we've seen these again, you want to have the patient to do these in both the vertical and horizontal. My oculomotor smooth pursuit exercises were on the vertical. You can have this done in the horizontal. You get an idea of our level 1.5 adaptation exercises. Every time we move up a level, we take it up a notch. This time, we're going to focus on reading with head movements, movements of the target and head should be in the same direction, and again, the speed is going to increase as the ability increases. So instead of a stable target like 1.0, the visual target will move, and now we've got to follow it as it pops up, so these are like saccades, but using your nose to follow the saccade.

So if everyone could follow along with us as we do this video, this is the second half of that same YouTube link, and the numbers will appear on the screen, so you're gonna use your nose as an imaginary pointer to point to each number as it appears on the screen using your nose, not your hands or fingers, and the second set will again be faster than the first. So, two, three, we should all look like cats following a ping pong ball or tennis game around if you're doing this with us. I make my students do this on a big projector, it's really fun to watch in the classroom because I've got all these students look like they're watching Pong or something else as they are following it. So now we're gonna do a smooth type of movement, so again, following the trucks with your nose, not with just your eyes, and again, the second set will be faster than the first, so just moving your head from back and forth while watching these moving targets. And hopefully, you're just making a nice, smooth back and forth head



movement with a moving visual target. A little faster each time. And that's all it is, very nice and simple, something that's easy for us to do, took just a few minutes. You've completed one cycle of exercises, good job, pat yourself on the back, you've done some level two, and the level 1.5 exercises. So back to our PowerPoint, again, we're going to do this in both the horizontal and vertical conditions, seated, standing, and you could also try to do these while walking, but again, a nice simple video that you can create, you can use mine if you want, you can share with your patients for some simple exercises. Again, it may take a little while from the time they see you until they see the physical therapist, so these are exercises that can be done at home everyday to kind of help to spur the process of recovery. Next type of adaptation, we're gonna move it up to level three, so if we had head moving and target moving in the same direction, level three is going to kick it up a notch, and now we're going to have the head moving while our target is moving in the opposite direction.

And again, increasing speed as ability increases, we're going to have it horizontal, seated, moving, standing while seated, standing and walking, so we're gonna see first a video of a person seated. Good ol' Chuck sitting there. Our VOR three, we're gonna watch that one first, and you'll see he's moving the card in the opposite direction as the head movement. This is actually really hard to coordinate, so this is also something that takes a little bit of effort to do. So as your patient does this, again, they've been able to do the previous exercise as well, we're moving to a higher level exercise, so that's with head movements in the horizontal. So now if we look at VOR two, we're going to see that he's moving, watching the move from left to right as he's bouncing on a physio ball. So we have left to right movement, and then we also have vertical movement, so we're really engaging a lot of our vestibular system with this. These physio balls are amazing. So now that you've seen an application of this in the home setting, let's get back to our exercises, and again, just increasing the difficulty as this goes on for the patient as they get stronger, as they gain confidence. This is not a level exercise you would give to a patient immediately after they've had an insult, this is something that will take a little while for them to get to. Hopefully that'll help to make

sense that this does take a little while. Just like you're going for a marathon, you don't go out and try to run 10 miles the first time you train, you go out, you do the couch to 5K, and then once you've got the 5K mastered, you go to the 10K, and you work your way up over time. Adaptation exercises, we talked about moving from slow to fast. That's not just for the patient's comfort, that's also because these exercises must be done at multiple frequencies. Exercises performed at low-frequency head movement do not carry over to improve VOR gain at high frequencies, so you have to do high frequency head movements to improve the VOR with high frequency head movements. Seems kind of simple, but that's the way it is. With your adaptation exercises, visual engagement is critical, because we were also engaging the reticular formation, which is getting visual input and utilizing that visual input all is part of that adaptive feedback, which is all of that adaptive feedback does come from that cerebellum. So we've got reticular formation, digital input, and the cerebellum all working together in terms of getting these figured out. Any questions about adaptation exercises before I move onto habituation?

All right, moving on to habituation. What is habituation? Habituation focuses on reducing symptom intensity and duration through repeated exposure to the offending stimulus in small doses. And these are done either using a standardized tool or through patient interview. I apologize, I keep muting my mic because I'm getting over a cold, so I try not to cough in your ear, hopefully nobody's getting their ear coughed in. With adaptation, excuse me, habituation exercises, let's go back again to our traditional audiologic patients. What is habituation in our audiology terms? Again, we're looking at treatment of the vestibular disorder so if we want to talk about treatment of an auditory disorder, we're talking about treatment of hearing loss. And we talk about habituation in the treatment of hearing loss all the time when we talk about hearing aid use. Oh, got a couple questions, let me see. So to back up, got a couple of adaptation questions that came through. The frequency range for head turns when performing adaptation exercises, Crystal asks, what is the frequency range? The frequency range for adaptation exercises, you need to start at least at 60 hertz and go up from there. If that

makes sense, 'cause that way, we're actually engaging the VOR. Now with that said, if that's too fast, and your patient is completely still dizzy, you're exacerbating, they won't do it, you start as slow as you need to and work your way up gradually. Our natural head turn frequency, we get up to 6,000 degrees per second in natural conditions, so don't be worried about they're going too fast in terms of that it's not gonna be carried over. I'm more worried about going too fast in terms of making my patient really uncomfortable. Hopefully that answers your question, Crystal. All right, Ingrid, in terms of VOR adaptation, what type of pathology or symptoms? These exercises are primarily for people with unilateral vestibular loss or partial vestibular loss. So with adaptation, we're using that vestibulo-ocular reflex and the vestibulo-ocular reflex, we need to have some vestibular input.

So the only group that this really would not be good for are those people with complete bilateral hypofunction, so if you don't have vestibular input, you can't improve the VOR. And Steve asked why do we use VOR 1.5 and two for the VOR adaptation? VOR 1.5 appears to be central oculomotor, and level two, a VOR cancellation exercise. Great questions, so start first with a 1.5. If we're looking at the vestibulo-ocular reflex, in addition to training that impulse from the vestibular system, sometimes we have to actually work on the muscles of the eye so you're right, those are central oculomotor exercises, but those are a component of adaptation exercises because we need to make sure that the eye movements are going to be correct. Sometimes, 1.5 is more done by your optometrist, that is, a vision therapist, and so if that's something that you're going to leave to them, I can appreciate that, however, having good oculomotors are essential to proper VOR, so that's why I'd include the VOR 1.5. And the level two VOR, it's not a VOR cancellation per se, because we're moving our head but we're staying focused on that, so we are still engaging the VOR, so VOR cancellation is, I think you're looking back at your like rotary chair type of testing. When you're looking at an object and it's moving in the same direction as you are and you're keeping focused on it, you're still using that VOR cancelization, but you're having to engage that VOR in order to hold those eyes in place. Hopefully that answers your

question, clear as mud, maybe. Ask me another question if it still comes up. Okay. Gonna move on to habituation. Thanks, Steve. And we'll come back to any other, if there's still adaptation questions, we'll get back to 'em at the end, so habituation. Habituation, like I said, we talk about this in terms of audiologic terms with our hearing aid patients, but we don't call it habituation, we call it adjusting. So with our audiologic hearing aid patients, we say okay, you may hear things you haven't heard in a while, and your brain might be a little bit weirded out by this. You're gonna hear the turn signal on your car, you're gonna hear the refrigerator kicking in, you're gonna hear your footsteps, and at first, it's gonna be really bothersome, but the more you wear the hearing aids, the less bothersome it will become until it becomes part of just who you are naturally again. This is also what we're doing with habituation, but because it is more of a visceral response in terms of dizziness, we don't have them do these exercises constantly, or else we're gonna have a bunch of puking patients. My goal is to not make people puke. It's always a great goal, I'm gonna set that standard, no puking, so we're going to do this in small doses for our vestibular patients.

And again, these can be standardized tools that we use in terms of habituation, or through patient interview, you can find out what is causing their discomfort, and then figure that those exercises are what we should do, or exercises focused on that should be what we do for these vestibular rehabilitation exercises. I keep trying to use my keyboard, okay. For standardized habituation exercises, what our physical therapists and we could do is take our patients through the motion sensitivity quotient and the motion sensitivity quotient is a slightly longer activity-based assessment where we have our patient move through 16 positions or movements, and with each position or movement, the patient is asked to rate intensity and duration of the symptoms, 'cause again, the focus of habituation is to reduce intensity and duration so we want to know where we're starting to begin with so we can say okay, I'm starting at five, let's get it down to one or two. As this patient goes through their 16 positions, the clinician records what the patient says, and also is looking for nystagmus in these positions. And I've included a link to a printable version so that you can decide whether or not

you want to incorporate this into your clinical practice, but let's watch a video of my dear dad going through these rather quickly. So what he's gone from a sitting to supine, so that's the first one, and then I say, "Okay, how are you feeling, any dizziness?" He says, "Nope, I'm doing fine. "Okay, I just want you to roll onto your left side." My dad is the king of awkward, so he's looking extra awkward, I learned it from him. "No dizziness, okay, let's roll onto the right side. "Any dizziness here? "Nope, feel pretty good. "Okay, back onto your back, and give me a good sit up. "Any dizziness? "Nope, not at all, so we're gonna move on to the next one." Next we're gonna do a Dix-Hallpike, and I did it modified with him arching over a pillow, and so we're doing a Dix-Hallpike to the left, that is condition number five. Hangs out there for a minute. Trying to determine if there are any dizziness, and I do this little faster for educational purposes. Dix-Hallpike to the right, sorry, is number seven.

And then sitting up is number eight, so we look at it when they're laying back in that position, and also when we're sitting up, so he's gonna sit up from that, that's number eight. Next condition is kind of funny, what you're gonna ask your patient to do is have the head tipped to the left knee as they're sitting, so my dad had some difficulty following these directions, but we're trying, we're getting there. Okay, to the left knee and back up, and then nose to the right knee, and back up. Again, down is one position, back up is another. Any of these cause any type of symptoms? How long do they last, how strong? Now, we're going to have some five head turns, so just turning your head from right to left five times. Does this cause any dizziness? If it does, how much, how long does it last? So head pitches, so nodding the head five times. Does this cause any dizziness? If so, how much, how long does it last? No dizziness, an asymptomatic dad. And now I have him stand and turns completely 180 degrees. Good, any dizziness, no? Okay, and then turn back 180 degrees to the right. So I'm going around this way because as the clinician, I need to look at the eyes afterwards. 180 degrees to the right, no problems there. So that's the complete MSQ. Took two and a half minutes there. Might take a little longer if you actually have them hold the Dix-Hallpike, it could take longer if you're actually provoking symptoms, but that gives

you a good idea of the motion sensitivity quotient. Again, this is a nice standardized test where you can again rank that patient's symptoms and duration and you have exact exercises or exact movements that cause these provoking symptoms. And then you can focus by having the person do these movements everyday, try to see if we can reduce that intensity or duration. Of course, again, vestibular rehab, not for people with BPPV. That's a treatment thing, we're gonna do the Epley or the canalith repositioning procedure, but for those patients who, maybe the Epley is not quite, you don't get a normal objective, or you get a normal objective, but it's subjective, and it's not quite the same subjective as you would for BPPV when you do the Dix-Hallpike, so maybe just being in that position causes it for them. Some other exercises that can be done for habituation, we've got some custom-based exercises, just ask your patient, sit down and have a conversation with them. When I look over my left shoulder, okay, we're ruled out vertebral artery insufficiency, we've ruled out cervical issues, we've ruled out BPPV, let's see if we can just, this is an exercise, again, stable vestibular system. It's neuritis, but their trigger is looking over their left and right shoulder. I want you to do that three or four times every day. You want to gently guide your patient through repeated exposures for three to 10 minutes about three times per day until those symptoms subside, or at least you're at a tolerable level. Some patients never report complete symptom dismissal.

However, they can say, "You know, it's not near as bad. "I still feel a little woozy, "but I'm able to get through my day now." And that's really what we want them to do, we want them to be able to function. And there should be maintenance exercises. This is a marathon. Every day, we put our vestibular system through a marathon. And so if you have someone who does these exercises until they get better, but then they resume the sedentary lifestyle, their symptoms will come back. So if they have a active lifestyle where they're doing these movements, now that they've been able to get over their symptoms, they're able to resume an active lifestyle, great, but if they're just sedentary, they should do these everyday. Another example of habituation exercises are the Brandt-Dardoff exercises. We're gonna go ahead and see this video because it's kind

of funny. This is a video of me from a couple years ago doing the Brandt-Dardoff exercises. I'm doing them rather quickly because I'm in pretty good shape, but these are basically the Brandt-Dardoff exercises. You're having the patient lay down and sit back up from both sides. To me, these are a habituation exercise. You're exposing your patient over and over to try to reduce symptoms. Not a fan of these for BPPV, but that's another conversation for another time. All right, we've gotten through habituation exercises, are there any questions regarding habituation exercises in terms of who will it be good for, who it wouldn't be good for, those types of things? Well, I might as well answer that, because we're looking at symptoms, the habituation exercises are a little bit more overarching. We have that ability to actually work with a patient across multiple things 'cause we're engaging multiple systems with habituation exercises. Limited benefit again to those people with fluctuating pathologies, limited benefit with someone with vestibular bilateral hypofunction, but we can see some benefit with that. If we have a true vestibular hypofunction, we're gonna be using these sensory substitution exercises. I'm gonna pause and wait and see if there's any questions that come up.

All right, I was able to get a sip of tea and no one asked a question, so we're gonna move forward, and now we're gonna talk about sensory substitution. Sensory substitution is just that. The vestibular system is not giving us the information we need, and so we're going to have to use other systems to substitute for that vestibular loss, for recruiting other parts of the balance system to replace that missing piece. So again, let's go back to a basic level, what creates our balance system? Our proprioceptive or somatosensory system is one part of it our visual system is another part, our vestibular system is another part, and then the things we don't really consider as much are the autonomic aspects and the cognitive aspects, but those are parts that we will consider when we're talking about the balance system, and again, with sensory substitution, we're just not getting the vestibular input that we need. So the first level of substitution exercises are these proprioceptive exercises, and what we're wanting to do is improve that somatosensory or proprioceptive reception and/or input to our balance system. So

we're trying to remind our brain, hey, our body is giving these really great impulses to us. We've got, in every single muscle fiber, we have basically tension sensors that tell us where we are in terms of pressure, so we're gonna utilize those. We're gonna use our tactile sensation so that we can get information about that. So we're gonna do some sensory exercises and we're gonna do some standing exercises. I do encourage these to be done barefoot so that we are maximizing our sensory input, and we're gonna use multiple stimuli. We're gonna do these exercises first seated, then standing, and we can utilize the addition of canes, walking sticks, but these are not for support, we don't want our patients leaning on canes or walking sticks because then we've messed up their center of gravity, we've messed up their ability to gain support, but these canes or walking sticks are adding additional proprioceptive input so that our bodies know what kind of things we're walking on. Very, very helpful, especially people, these walking sticks or canes, we may have patients that have poor proprioceptive input from their feet, and so as we're looking at these sensory substitutions, they may still have good sensory appropriate input from their hands, so specifically I'm thinking about a patient who has diabetic neuropathy.

So, diabetes is such a hard-hitting systemic issue. It can affect our hearing, it can affect our balance in terms of yes, we can actually have neuropathy at the vestibular end organ because of diabetes, and uncontrolled diabetes. We have peripheral neuropathy with these patients so they're not getting proper proprioceptive input from the feet, and also diabetic retinopathy, so now they may also have vision loss. So these can be really, really bothersome, and so if you have a patient who, their sensation in their hands is pretty decent but their sensation in their feet is not, and they're not getting the visual and/or vestibular input they should have to stay balanced, having a walking stick where they're just kind of tapping ahead of them to know what the ground is like ahead of them can be the difference between being able to walk around and be independent to someone who's just gonna shuffle and kind of never leave the house, so definitely something that can be helpful. So let's move away from the walking sticks and go back to these exercises. And we have a video here that is



narrated for these exercises. So the patient is to stand touching the wall with their feet together, eyes open to start with, and eventually, they will have less and less tactile information. So you see, I pulled my hand away from a full hand, no support from the wall, fingertips, a few fingertips, one fingertip, one fingertip really close. First on eyes open, and then eyes closed. So going back to our slides, these are exercises that kind of let the person know okay, I got a little, how much can I stand? How much proprioceptive input do I need for my hand to stay balanced? And this is something, I moved it through it very quickly in terms of from a flat hand to fingertips to a few fingertips to a gently touching single fingertip to really close to the wall, and helps them to, instead of having to put a flat hand on the wall anymore, they can just hover over some areas and know that they're able to stay by supported. Also using the feet, 'cause they're saying okay, now I know my feet are there, okay, I'm listening more to the feet, I'm taking less away from the hand.

So all kinds of exercises that can be done in terms of those sensory exercises. You can notice my stance on this, my feet are further apart. You will also want that person to move from a nice wide stance where they're very solid supported to a more and more narrow base of support, challenging them more and more in terms of their balance. Entire body proprioception can also be used for substitution exercises. Walking and standing on a compliant or uneven surfaces is a big one for our patients. We've all seen this patient, you come in, you do a modified Romberg on them, and when they go to try to stand on that dense foam, they just can't do it, even with their eyes open, they really struggle with that, or they're wiggling a whole bunch. And you say, "Now, this is an area where you have some weakness. "Maybe this isn't to do with the ear, "but this is an area you have weakness, "and I don't want you to fall, "so let me suggest you try some things at home "so that you can get stronger "at being on an uneven surface," because in the Pacific Northwest, our ground is typically very hard from the months of June to early September because we get no rain, yes, actually in Portland, very little rain from June to September, but starting in September, the rain faucet turns on and it kind of stays on until April, May, somewhere in there. So after August, my patients step

off of the sidewalk and onto the grass, it's gonna be squishy, and if the patient is not used to being on a compliant surface, they're gonna go down. So in order to strengthen this, I'll say, "Grab a cushion off of your couch. "Stand next to that couch, "something really strong for support, "if you can be in a corner, even better, "but if there's a lamp behind you in the corner, "don't stand in front of the lamp, "you're gonna knock that thing over. "I want you to stand on the couch, "I want you to have your hand," excuse me, not on the couch, "I want you to stand on the couch cushion "'cause it's nice and thick, "I want you to have your hand on the edge of that couch "'cause it's nice and supportive "not because I want you to lean on it, "but I want you to have that tactile there just in case, "just so that you can start to get stronger. "I want you to stand on it for a minute "during the commercials while you're watching TV. "Do that a few times a day, three, four minutes a day, "and as you get better at it, "I want you to try to take your hand off of the couch "so you're not using as much tactile support," kind of like that video that we just showed where you've got a firm hand for support, then you've just got some fingertips. But this will help your patient, or your family member or your friend work some of those ankle, knees, and hip type of adaptive reflexes so that when they go onto a surface that is a little bit softer, their body knows what to do, so I highly recommend that.

I mentioned Tai Chi before, there are beautiful articles out there looking at falls risk and Tai Chi and how you can reduce falls risk through just basic Tai Chi classes, partially because of this stance that is being shown right here. With Tai Chi, you are shifting weight slowly from one to the other, and there's a lot of single leg stance. When we get off balance, we have to be able to pull our weight back to center and be able to support ourselves often on one foot. As we become more fearful of falls and/or as we age, a lot of us adapt to a shuffle step. That shuffle step seems a lot safer, especially if maybe you're walking through the bedroom and trying not to trip over a dog, rather kick the dog than step on him, but that shuffle step makes it so that we trip over things a lot more easily. So that shuffle step can make it so that we also don't engage our core muscles as we're trying to walk, and therefore, these Tai Chi exercises can be

really beneficial in terms of sensory substitution with proprioception. Yoga also puts us in a bunch of weird positions and makes us much more aware of our bodies. Speaking of the core, I'm actually gonna talk about engaging the COR in terms of substitution exercises, and the COR is the cervico-ocular reflex. So these are gonna look a lot like our gaze stabilization exercises, but again, this is for a patient who doesn't have very good or any vestibular input to the system. So what we're trying to do is engage the cervico-ocular reflex, there are muscle spindles in our semispinalis muscles of the cervical region that can actually send information to the vestibular nuclei that then goes up to the oculomotor nuclei as to where we are in space to keep vision clear. People with normal vestibular function do not typically utilize the cervico-ocular reflex. However, people who have damaged vestibular systems can train it and engage it and get some benefit from this gaze stabilization from the cervical region as opposed to the vestibular. And these are gonna look the same as those adaptation exercises, level one especially, so I don't have a video for this one. Again, we've got those oculomotor exercises. Maybe we have the patient, we want to make sure that their oculomotor input is working extremely well, so we talked about using the proprioceptive input, the cervico-ocular reflex, now let's talk about vision.

You can actually train saccades to be faster, and you can train smooth pursuit to be more accurate. The aging adult tends to have less accurate saccades and less accurate smooth pursuit because of a lack of use. This is a muscle system as well as a reflex system, so if you can train those muscles by doing those oculomotor exercises, then you can actually improve the eye movement and the eye's ability to give vision input to the whole balance system. I'm not going to have a, see these again, these are the same oculomotor exercises that we did in those 1.5 adaptation exercises. Sensory substitution exercises: visual, again, looking at some vision, but instead of a cervico-ocular reflex or oculomotors, this is an oculomotor portion that we don't typically do when we're doing the adaptation exercises, and these are going to be convergent and divergent eye movements. So that means movements that bring our eyes together as something gets closer to us and movement that has our eyes broaden, not so that

they're looking two different directions, but as we look into the distance, our eyes are no longer divergent, but they converge, excuse me, they diverge in order to look at distance, they converge, they come together to look at the closer ones. So let's take a video of this, the first video is a picture of Chuck, and he is, so converge to, he's taking that business card and he's bringing it closer, and it's kind of like when we were little kids having fun trying to make our eyes cross, but working some close convergent-divergent eye movement exercises, and making it so that we can focus faster as we are moving those things from front to back. The next video is going to be looking at something close and then looking at something far away, so he's looking at the business card, and then he's looking at the clock on the wall. So there's a clock in that top corner in the right, on top of the dresser, looking at the business card, then looking at the clock on the dresser. So, to the business card, to the dresser, back to the business card. So again, if we can work those oculomotors and make it so that as we have these eye movements that are close to far that are more accurate and more clear, we're going to be able to utilize that visualization, or visual system better as we are using it in sensory substitution. So yes, oculomotor exercises, these are oculomotor exercises, however, part of the balance system, part of what we're using for sensory substitution.

So back to the other type of core, core stability exercises. With core stability, as we know, as we sit in our chairs, as we are less active, our core strength diminishes, but if we can increase the physical stamina through walking or stationary bikes, we can increase core stability, so that if our patient is in a situation where they start to get off-balance, they can engage the core muscles and hold their balance better. Again, this may be seen in that patient that gets up on that dense foam, eyes open, they really can't stand on it very well, that can also be a core muscle issue. And there are a lot of ways that people can increase their core stability. Of course, there's walking and stationary bike, small squats, there's mini squats, don't need to have someone, especially with poor knees, going all the way down to a seat and getting back up, but mini squats. Yoga or Pilates are some common ways that people like to address this.

Bar type of exercises, and when I was in rural Virginia, I had patients that their granddaughters were in ballet, and they just thought they were the cutest things. And I said, "But did you do ballet when you were little?" "Oh, I just loved it." So my patients will get their granddaughters and they'd stand with a hand on the kitchen counter and do plies together, and they'd do it in first position, then second position. What they're doing is a small squat. They're making sure that their body is properly aligned, they're not dropping one hip or the other, but doing a mini squat, and they're helping to improve their core strength that way, in a fun way that they can do with their granddaughters or grandsons. Water aerobics can be a good core strength exercise, as long as you are not going to water aerobics for the local gossip, but you're actually doing exercise, my mother.

Overall strength and falls prevention, you can have someone just doing single-leg stances. Single-leg stances, so as I said before as we start to fall, we move from having our core center of balance to being a little bit off, and we're gonna have to be on one leg, so if a person can stand on one leg, they're going to be better at actually regaining their balance. I recommend single-leg stance practice for almost all my patients because it's a good thing to practice. And if they're like me and they do the dishes in the evening I say stand on your right leg for 10 seconds while you're doing dishes, and then stand on your left leg. You're right there by the kitchen cabinet, if you start to fall, you can just put an arm down and lean if you need to but try to keep your body completely upright, hips balanced, so you're not dropping a hip to one side or the other, and stand on that one leg for 10, 15 seconds, and then do the other. That's gonna be a really easy and simple way to improve core strength and reduce falls. Tai Chi again, I'm not gonna revisit that, but that's a nice one for core strength. Functional reach test, that's a test where the person puts their arms out and they try to reach as far as possible and then come back to center, so they look like they're doing the first part of the Macarena, they've got their hands straight out before they turn the hands up, so hands straight out, they're standing up, and they just lean forward a little bit, and then come back to center. Just doing that a few times actually engages the core,

for someone who maybe is a little afraid of exercise. Standing crunches is another one that I see recently where you're just standing and you pull the core muscles in, tuck the pelvis a little bit, hold it for 10, 15 seconds, and then release. I need to do all of these, but our patients are not able to do this. All right, am I back? I'm sorry, I saw that we lost some audio there. Okay good, sorry. Thank you very much Christy and Kimberly, I was afraid that you guys lost me. All right, so again, some standing crunches, some functional basic overall core strength exercises that I would like to do as well. Now to the last part, psychological and cognitive aspects are one of the last two. So I know our time is getting close. Overall awareness of our weakness and strengths of the balance system are really important in terms of making sure that our patients stay safe, especially if they have balance issues. A patient who is hypersensitive and is afraid of falling when they really don't have as much of a weakness physically is just as bad as a patient who is not aware of their own limitations and will go out and put themselves in danger.

So part of these exercises also makes someone aware of their strengths and make them a little bit aware of their own limitations, so that they are able to be safe in their environment. Use of vibrotactile devices can be very helpful in terms of training the balance system, and these vibrotactile devices can be used to warn of deviations from the center of balance, so there are sensors that can be worn around the hips that can help people train balance by getting a vibrotactile feedback if they're starting to sway. And we've kind of seen those, I've seen a lot of advertisements for these on social media for the posture ones where the slouch, I don't know if anybody else has seen these, where you put them between the shoulder blades and you start to slouch, it either sends you an auditory or vibrotactile cue, say, "Hey, sit up straight, you big lug." These types of things have also been used in terms of training for balance. Through exposure, we're also going to have calming of both an autonomic and emotional response, so part of that habituation is not just the vestibular aspect, but we're also addressing those psychological aspects of dizziness, same with habituation, same with adaptation. So these exercises are kind of like having a little bit of cognitive behavioral

therapy for your patient, but just without the psychology aspect of it. All right, one more thing, home modifications. Again, looking at sensory substitutions, we want to make sure that whatever sensory substitution that we're providing for our patient or suggesting for the patient is properly utilized in their home. So for patients, we need to think about, we're talking about maybe the visual aspect of sensory substitution. Well, let's look at their glasses type. Do they have a progressive lens, a bifocal, or a single vision type of lens? Well, those glasses types, I've just listed the most dangerous to least dangerous in terms of falls risk. So, a progressive lens bifocal, especially with a very narrow visual corridor provides very little input to our patients regarding their peripheral vision. They have a very narrow window of where they could see in terms of their ability to focus.

So if you have someone who's got progressive lenses, you might want to talk to them about either having a wider prism, using a bifocal or even the best thing would be to use two different pairs of glasses, one pair of glasses for distance, one pair of glasses for reading. A nightlight, so critical. We don't think about nightlights for adults, we think about them for little kids, but nightlights are so helpful when we have our patients that needs that extra visual input. I actually recommend nightlights for all of my adult patients, audiologic and vestibular because the nightlights are just really helpful. And this is a beautiful one, my PowerPoint has a link to this person's Etsy site, he gave me permission to use the image of his really pretty nightlights, just a basic, giving some vision, making sure they're not walking in the dark, and possibly tripping over something. So again, you got to have vision, but you also want to remove some trip hazards. Throw rugs are a trip hazard, a fall risk, so trying to reduce throw rugs, electrical cords, making sure that they're tucked away, have something over them, intrusive lamps, plants or furniture, and this image below is just kind of a picture of what could have been my grandmother's house, but is also an extreme falls risk. We've got a very narrow corridor for walking, we've got things that are sticking out all over the place, we've got sides of chairs with blankets on them and the blankets are hanging out, so they're not really able to walk through there without getting snagged or trip. So

our patients, even though it's not really within our scope of practice to go home with them, we should make these recommendations, make sure you have a clear path. The other thing that we don't think about are little animals so dogs and cats, so make sure you know where your animal is before you step. Okay, quick core summary. Number one, vestibular rehabilitation is important for our patients. Number two, VRT is important to know as an audiologist because it's important for our patients. It's important for us because our audiology patients are going to be likely to be at a falls risk, and therefore would benefit from VRT. It's important to know that not all patients will have the same outcomes for a whole variety of reasons. Part of it, that fluid mosaic that the vestibular rehab is going to be different for each patient depending on their pathology, their personal motivation, other confounding variables, and what they are wanting to do in terms of goals. And you can diagnose and treat your patients.

So think about what your patient has in terms of pathology, counsel them appropriately in terms of what they should start doing and who they need to see next, so if we have a patient who has a unilateral vestibular hypofunction and it's something like neuritis, let's get them started on those exercises immediately. We're going to have their best benefit, we want to get them a physical therapist that specializes in vestibular rehab. If we have a patient that we're gonna use sensory substitution and we noticed maybe they've got normal, but just barely normal oculomotors we want to get them onto an optometrist who specializes in vision therapy, and we want to make sure that we are addressing their needs as they are. So I have about a couple minutes for questions, thank you so much for listening to me today. I see one question. Someone's wondering what Sudoku is. Sudoku is a number-based game, this is looking at the questions for the overall outcomes measure. Sudoku is a pen and paper number game. Oh, yay, I have friends from across the pond, thank you. I had someone from across the pond say thank you, hopefully it made sense. I'm sorry for those that lost audio, hopefully the recording will be helpful.



- [Christy] Thank you so much, Dr. Hogan. We're gonna leave the floor open just for another minute or so. I wanted to read a couple of the comments here that everyone is sending in. Overall, such a wonderful presentation. Steve says very informative and clear and presented. A huge thank you from the UK. That's the member that you mentioned from over the pond. Vicky also says thank you so much.

- [Anne] I'm doing a little happy dance over here, I'm glad you guys liked my presentation.

- [Christy] Thank you Carolina, she also mentioned a great presentation as well, and I agree with all of the comments. We are just so grateful to have Dr. Hogan come on today and share her expertise and her time with us. Dr. Hogan, if you wanted to go ahead and leave any last comments, and then we'll go ahead and close out the classroom.

- [Anne] I just wanted to make a final comment that the presentation that you have, if you download it, there are a couple more slides after questions, I just wanted to give you some links to some really nice resources. There is some resources for, about vestibular rehab that's really patient-friendly on the VEDA website. If you're not familiar with the Vestibular Disorders Association, VEDA, great group, wonderful patient advocacy, lots of great resources for the patients there, and I really felt like their article on vestibular rehab was very patient-friendly and also very accurate, so I provided that link, a nice review article on VRT that you could read a link to that, and then a cool website regarding what you can learn about oculomotors there. There are links embedded throughout the presentation, so please utilize those, and enjoy. Thank you all so much for coming and listening.