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Visually Induced Dizziness
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Presenter: Amy Lennox-Bowley, AuD

- Welcome everybody, and thank you very much for being with us today. My name is Anna and I'm the educational manager in Inventis. This is the last appointment with Inventis Academia before the end of this year. Academia Educational Program is an initiative aimed to promote scientific delegation on topics related to the equipment we supply among professionals in hearing and balance care. Title of the webinar is Visually Induced Dizziness.

We asked with great pleasure Amy Lennox, that I would like to thank for her collaboration. Hi Amy, and thank you very much for being with us today. Really appreciate it. Amy is an audiologist and founder of Hypatia Specialist Clinics and Hypatia Training, which aims to improve vestibular care by providing innovative clinics for patients, and mentorship training for clinicians worldwide. Amy is also a visiting lecturer for a number of universities in the UK. Here with me, an always welcome presence, Dr. Enrico Armato. Enrico is a doctor at UHL-STRA, sorry, region Veneto here in Italy and in this clinical reference for balance. Thank you Enrico for your presence today. Much appreciated.

- Thank you.

- As usual, I invite all of you to write down any questions in the space provided that you should see on the screen. Amy will answer the questions at the end of the webinar, or during the webinar, Amy, it's definitely up to you. After the event, you will receive a survey I'd kindly ask you to fill out. The survey will help us to understand your needs, and to get your ideas in order to provide the best educational support ever. Now, I leave the word to Enrico, and then Amy, it's your turn. Enjoy the webinar and see you later.

- Thank you Anna for your introduction, and Amy, I am so happy to see you again. I met Amy the first time last July in Liverpool. I attended an amazing vestibular summit

organized by Amy and my dear friend Dr. SOO-MIHT Gupta. I spent there, three fantastic days. I met new friends, all professionals in the balance field, and I met older ones as well, a great opportunity to share our knowledge and new ideas. But Amy, now the floor is yours. Enjoy the webinar.

- Thank you Enrico, and thank you Anna, and thank you to Inventis for having me here tonight. I'm really looking forward to exploring more into visually induced dizziness. So, let's get into it. So, visual vertigo or visually induced dizziness as demonstrated here by Fluffy the cat, is dizziness or vertigo as a result of being overstimulated by complex visual environments. There he goes. So, why does this happen? So, usually when it comes to balance, we know that the main inputs to balance are the vestibular system, the eyes and proprioception. And for balance to work effectively, usually we have equal and/or opposite signals, especially from our ears. When it comes to the vestibular system and the ear, say, something happens to the ear, the information that's coming up from the ear is no longer appropriate and therefore the information that comes in from the eyes is a lot more, is weighted, is prioritized by the brain.

And the way I describe it to patients is, because I'm ear led, because my ears work correctly, when I see motion, I don't feel the motion. However, because with you, because you now have a vestibular problem, you are no longer ear led, you've become eye led. And so when you see motion, like a car moving along the street, you may feel that motion because your eyes are the priority, they're the lead sense of the driver. The other thing to note as well is that the vestibular system is very, very complex at the cortical level, and there's many different structures within the brain that link directly into the vestibular system. And back there, at the very back is the visual cortex.

And we know from when we compare normal healthy people with patients who are complaining of visual induced dizziness, when we do a functional MRI, we can see that their visual cortex, it lights up like a Christmas tree, definitely is working a lot harder.

There's other current considerations though to think about. Sometimes healthy subjects will talk about mild visual vertigo. The reason for that is that body sway is directly linked to your pupillary size. And so, when your pupil size gets bigger, you are more likely to feel more body sway. And this can lead to visual dependence. It tends to happen when you are looking at a busier or more dynamic environment. So, there are reasons for healthy people to also get visual dependence.

The patient doesn't necessarily have to have a specific vestibular disorder. It could be any type of peripheral or central vestibular disorder that can cause visual induced vertigo. And with the kind of understanding of PPPD, we know that a lot of those patients also tend to always have some sort of vision induced vertigo. And it would be sensible to hypothesize that, does the visual induced vertigo prolong those chronic symptoms of dizziness? At my clinic, the last 75 patients that came through the door for diagnostics, and they could come in for as many different reasons, out of the last 75, 61 of them did actually describe some form of visual induced dizziness. So, it's quite, the prevalence of it, it's quite high in those peripheral and central disorders.

So, what might they say to you? So, I'm sure many of you have read or heard about supermarket syndrome. So, that's when they find supermarkets uncomfortable to walk in. They may also talk about places that have reflective floors, reflective walls. So, airports, train stations. They may describe things like action movies is quite tricky to watch, or they might be fine watching those at home, but then when they go out to the theater or the cinema, they find them really difficult to watch on those really big screens. The other thing is, in this century, we are deemed scrollers. We tend to go through our phones like this and the movement of the images changing on the phone can also induce some sort of dizziness, and that's quite a common complaint in our clinic.

Usually, there's some secondary effects as well. So it doesn't always, or it never really comes in a pure form of just visual induced dizziness. There's usually some other things going on and these are the types of things a patient might report on the history. So, general disorientation, general discomfort, partial instability. And then that makes us start to think about those patients with PPPD. They'll be restricting their head movements, they'll have excessive fatigue, brain fog, agoraphobia, which is fear of going outside, anxiety, and they'll just generally have worsening symptoms, worsening symptoms over time, especially if it's not treated. So, the other thing that patients might do is become maladaptive. So, they'll avoid situations that make them feel dizzy because that makes sense, right?

If you don't like something and it makes you feel sick, why would you then go on and put yourself in that situation? But what happens is that patients would be conditioned, so the more they avoid that situation, the worse it's gonna be for them in the long run to get back into that situation. And so, part of therapy and when we come to that is we're actually trying to encourage them to experience and live through the symptoms so that they can get stronger and more resilient to them. So yes, today we wanna kind of concentrate on those patients that have a peripheral or central disorder. But always do consider other eye disorders first before kind of thinking just purely about stimulant and central and patients, you should rule these things out too.

When it comes to figuring out whether your patient has visual induced vertigo, there are some questionnaires that are designed to help you. Now, if you are under time pressures, it's probably not appropriate to ask every single patient that walks through your door to complete these questionnaires, but you should have a few questions within your general history to kinda trigger you to thinking, Oh, maybe I should explore this a little bit further. So the good one is, you know, do you feel dizzy when you go into a shopping center, or, do certain environments make you feel dizzy, and that's an open

ended question. That might prompt them to say, Oh, I can't find the airport, or I'm avoiding walking down busy streets, et cetera.

These two questionnaires here that I'm showing on the screen are the visual vertigo analog scale. This is a nice fairly short questionnaire and the patient's just asked to score from zero to 10, and 10 being really bad, what they experience in the different environments. So, walking down a busy street, being on a patterned floor, those types of things. The vision related dizziness 25 questionnaire, that's a little bit more in depth. It takes a little bit longer but you do get a lot more detail. So, that is a very good one to do as well. And then you've got the PVID, which is the one that is for pediatrics. And yes, so don't forget that your pediatric population can have vision induced dizziness, and it is very common in children who have primary concussion, migraine, and other vestibular disorders.

It's good to quantify those symptoms to help them with specific management, same as with the adults. So, when it comes to management of visual induced vertigo, there's many different approaches you can take. It's always good to have a couple, especially considering usually these patients have anxiety. So, you probably don't wanna just work on the visual induced vertigo alone, you wanna kind of unpick what is going on with the person as a whole. So, vestibular rehabilitation, traditional VOR exercises, and ocular motor and OPK work, some postural and proprioceptor training, and to make them more confident in their body as a whole. You can go down the pharmacology route. At our clinic, we try everything else first. Looking at the behavioral aspect, why they're avoiding situations and how can you encourage them to deal with those situations a little bit better.

CBT, cognitive behavioral therapy, mindfulness. There's lots of actually really great mindfulness apps that have come out on the phone even in the last 12 months, which we've been exploring in the clinic if you don't have access to someone who can

provide a mindfulness therapeutic service to the patient. Dynamic visual acuity is a good way to check, retrain the VOR and strengthen it. And something we've been playing with for the last two years is virtual reality and we've been having lots of fun with that as well. But I would say, in most cases, it's a multidisciplinary therapy and if you don't explore the cognitive side of this, and you just try and attack the visual induced vertigo on its own, your success rate's probably gonna be a little bit lower.

So, when we're doing the vestibular rehabilitation, what are we trying to achieve? Well, what what we're doing is we're trying to get the patients habituated to the sensation. So, we're gonna repeatedly provoke the dizziness, what triggers them. And then so, we're hoping that over time, that desensitizes them. And don't forget that daily life is full of triggers and you wanna try and push patients past avoidance techniques. And it's really difficult to kind find the sweet spot for that 'cause you also don't want to overwhelm a patient. So, let me give you an example. If you've got a patient who is avoiding the supermarket, it's not a good idea to send them into a giant supermarket with a full list of shopping where they have to fill a trolley and they'll be in there for a long time.

It's probably more appropriate in the beginning to do something like ask them just to go into a very small shop and ask them to buy one milk. And so over time, you want to increase the difficulty of that kind of task for them. And it might even be that patients are not leaving the house at all. So then, walking down a quiet street is a good precursor then to get them onto busier streets, et cetera, et cetera. Working with the pastoral control is actually really good. So, tai chi is brilliant for patients. And there's a movement called cloud hands, and it's where you do tai chi, and you can do it seated as well. So, it can be very gentle, especially for the more vulnerable patient, and they can do cloud hands seated.

And what you're doing is they're moving their hands in front of their face a lot, which can trigger visual induced dizziness, and that's a very gentle way to kind of get them started. And if you strengthen your core, strengthen stability, that might help reduce a sense of body sway. So, often when they feel a high sense of internal body sway, that brings about kind of the anxiety around their balance as well. At the end of it, I'm gonna ask you all how many cats you've spotted in this presentation just to make sure that you're all paying attention. In the clinic, you can start, you can do visually induced dizziness therapy with basic stuff or you can go and buy these full OPK chambers and goggles and really high tech stuff.

But, I'm hoping that all of you depend on, doesn't matter what kit you have access to, will have something that you can have a go at. So, on the left here what you can see is an OPK chamber. So, you've got your black and white and then the patient will move on the chair in there. Or on the right hand side we've got a disco ball that was, I think about 15 pounds, 15 euro. And, so you can start by exposing them to kind of the disco ball with the lights in the room, gently. There's other things you can do. So, there's plenty of resources now on YouTube. So, here's an example of dots on rotation. And so, this one's quite busy, lots of different colors.

And you want to just expose this to the patient. Now, they might be only be able to tolerate it on a very, very small screen and that's how you would start. And then to make this more challenging, what you would try and do is make it bigger and bigger and bigger. So, take it from a phone to an iPad to a laptop to a wide screen TV. And the best way to kind of show these videos, I'll pause it just in case anyone watching doesn't like it. The best way to show these videos is in a darkened room. So, to take the periphery vision out of it. And so, that they're only kind of focusing on what they're actually looking at.

I think most of you'll be familiar with the Optokinetic line. So, just as an example, again, there's a few of these that you can access on YouTube. So, just left to right, I won't play this for long. And then you might want them to go the other way as well, right to left. And again, when I'm asking my patients to look at these, I'm not asking them to do it for long in the first instance. I'm just kind of gently going in there just to see what the tolerance level. And the advice given to them is if they, if they measure their symptoms or how horrible it feels, if they gauge it on a zero to 10, I want them to be working with something that's around a six, level six.

So, moderately symptomatic. Anything higher than that is too much. It overwhelms the system. And anything less than that, it's not triggering enough to kind of desensitize them. And so, what you should find is over time, they can tolerate more difficult visual information for longer. So virtual reality, this has been quite fun, and patients seem to enjoy it. So, we have two ways of delivering virtual reality. We have it where, we have a system that's controlled and we use it only in the clinic. And that's where we kind of push the patients a little bit harder with us, you know, monitoring them. And then we have a setup where the patients have the virtual reality headsets at home.

And so they can do a little bit of kind of top-up therapy every day. And the good thing about it is they can do it seated. It's a controlled stimulus. You can slowly increase the difficulty. You can isolate the visual exercise from complex sensory. You can take away the proprioceptors, you can take away the vestibular inputs. So, you're purely working with the visual input. Patient's in control. They can choose the environments that they're gonna be in and you can put them in really nice environments. You can put them on peaceful beaches with some meditation music in the background. It helps increase their confidence. It can be completed at home. And we started this when COVID hit.

And so, we were having lots of patients where I was struggling to deliver some therapy. And this is actually how I stumbled into this, was because I could, I could give them some task to do remotely more than the tradition, just the traditional vestibular rehab. But it does coincide nicely with traditional VOR rehab. And yes, evidence is starting to emerge. So, this is a nice study. There's a nice number. So, we had 98 patients with vestibular dysfunction and what they did is they compared a virtual reality therapy with a conventional vestibular rehab. And what they found was that the introduction of the virtual reality therapy provided more, kind of, more interesting interactions for the patients. So, the patients were more motivated to do the therapy and they tended to stay and do the therapy a little bit longer.

And with this, the score seemed to do really, really well. So, virtual reality, what type of things can you do at home with the patients? So, this is the type of video that I might start them off with. So, it's nice and simple and easy. And so, all they'll be doing is wearing a headset and this will be in 360. So, if they were to look to the left, look to the right, they will see trees everywhere. And the sound on this is a lovely crinkle snow. Additionally, you can ask them to task. So, you can ask them to look up at the trees, look down at the floor so that you start to integrate head movements as well.

And so, this isn't too, There's no people walking towards them. Very minimal colors. Yes, there's a few snowflakes, but it's not too heavy. So, this is quite a nice starting video to begin with. What I would do is ask them just to kind of see how long they can tolerate it, at a six out 10. And on the first couple of sessions, I never ask them to sit within the environment for more than a minute. But I would wanting them to work up to five minutes of looking at something like this. Very relaxing. But, you can make it a lot harder for them. So, here's an example of a more complex video. So, there's rain, it's noisy.

There's not that nice meditative music. There's cars going past, there's lights, there's billboards. So this is pretty, this is kind of the higher level stuff. So, and we do have patients who can't even tolerate the snowy ones to begin with. And then a few weeks later, they'll be absolutely fine in that type of, with that type of video and that type of environment. And so, it's quite nice for them to be able to see their improvement. And then if you went back to the original videos that they started off with, that they really struggled with, then they can sit through them, then they can to see the improvements themselves. And if you don't do this in virtual reality, don't forget what I said before.

You can still have a go at showing patients these. Just make sure that you, you would do these on a larger screen as they can manage with the room as dark as possible. So, in the clinic when I'm trying to test them a little bit harder, I've got a system where we can make them do things. So, make them walk around the supermarket and they will be in control of this. I know you don't have control of it so it probably makes you even, you feel a bit, ooh. But they have control and I would ask them to go looking for, I dunno, the beans, the milk, the eggs. And so, they would go around looking for the different items.

So, then this brings into dual tasking as well. They're not just taking the visual input, they're also, you know, moving their hands, moving about. And gradually you can get them to, if you are confident that their posture stability's okay, you can get them to stand up. There are services that do use virtual reality systems and they just put them in supports if they're worried about their balance. Okay, well let me show you this case study here just cause this is kind of what was one of the first ones that got me interested in it. So, this was a professional ice hockey player who was a 25-year-old male. And he had three concussions, 2015, 2017 and 2018. He complained of visual induced dizziness and they measured that he had reduced gaze stabilization.

And so what they did is, they mixed a bit of vestibular rehab and OPK work with him. So OPK, remember, is that black and white stripe training. Okay, so not for virtual reality. And so what, this is how they broke down the therapy. So, you can see therapy is on the, the therapy day's in the column on the left. So, he had day one, day two, a different type of traditional vestibular exercises with some OPK trainings. Then he had a couple of days off. And then they increased the vestibular rehab with further OPK training. And then his scores. I know there's a lot of writing here on this page. But what you're looking at is where I circled, you can see his VVAS scores.

So, pre versus post. So, remember 10 is the highest you can score on the VVAS as in being 10 being terrible and zero being really, really good. So, you can see after the five days of therapy, yes he had a couple of days breaks in between, but you can still see that his scores have come way, way, way down. I mean walking over a pattern floor went from an eight to an 0.2. So, that's pretty impressive. And we've seen similar. This is very good, actually. But we have seen similar kind of reductions in scores over time for sure. So, I'm gonna show you some of the case studies from our clinic. So, this is Paul. He was 29. He was in a car accident two years before we seen him, and he had a right vestibulopathy.

And, he hadn't received any treatments at all, and he had traits of PPPD, although no one diagnosed him with that. But he certainly had high anxiety and he had postural sway, well he thought he had high postural sway. And his DHI was 72. And so, what you're looking at here is his vHIT results. Now, if you're not used to looking at the impulse test, all you need to kind of focus on is if you firstly look at the top right hand group of scores, look at those purple spikes in the right lateral canals. So way, way up in the top corner. And can you see the kind of displays that are just scattered, what we call it.

And then if you compare that to the right lateral on the bottom left picture and can you see that they come become gathered? So, we know now that the saccades that we measure on vHITS, the more gathered they are, the more covert they become and can demonstrate objectively compensation. The other thing you'll notice is his right gain scores have come up on average in all three canals. Now the other thing we all also do is SHIMP. And we kind of have just been playing around with it 'cause we're still learning about SHIMP, but this was quite interesting to see. So, the top graph and table is his pre-therapy scores. So, he had an asymmetry ratio of 40% and you can see that his catch up, so how his eyes refocus on a target, that's what we're asking them to do, sorry.

So, we're moving a target, we're asking the eyes to catch it. So, it's all over the place, it's not timestamped at all. But then post the therapy, his asymmetry ratio dropped down to 23%, and his catch ups became very, very gathered. What that means is that when you are asking his eye to catch that target, they're very reliant, they've become very reliant, they know what they're supposed to do. They know where to go. And I don't think this is spontaneous because, because of the two year gap of him having no therapy and then all of a sudden he got to this point. And, his DHI scores also came down, right down to about, I think it was 16 or 18, I can't remember the exact number.

I meant to put on the sheet, sorry. But, it was around 16 or 18. So, that was quite good. And what he did for his therapy, sorry, excuse me, was, he was one of the ones during COVID, so he didn't come into clinic often for his therapy, he was doing it mostly at home. Now, he was a keen fisherman. So, what we did was we started him off with the slow walking videos, and then increased him up to kind of walking him around Hong Kong and New York. And then we moved him onto, there's a fishing video that you can do with one of the virtual headsets. It's very saccadic, so there's a fish and he has to aim at that fish and reel it in.

And then he kind of really enjoyed that, and that's something that he did in his real life that we could build in as part of like a rehab game for him. One of the games, he did pong as well. So, he was doing ping pong as well. And so, he would do five minutes a day most days and he was pretty compliant. But if he was having an off week where he couldn't be bothered doing it, he would drop to about three days. But most weeks I'd say he was doing five days a week of it. That was Paul. Then we had, or another one we've had is Simon, who's 65. He came to us and he's had 10 years of kind of non-rotational continuous dizziness.

And a big concern for him and more so his wife is that he was starting to become very withdrawn and he wasn't socializing at all. But he did have, everything else was normal, but he did have asymmetrical VEMPs and his DHI was 45, so pretty high. He couldn't tolerate the virtual reality. We did try it, but it didn't work for him. So, it doesn't work for all of them. And so what we did was, we started with the black and white lines on an iPad in the dark. And then we gradually increased and we managed to get him doing some work on his television at home. He's got quite a wide screen television, so we worked up to that.

And then so he would, A big problem for him or his wife is she wanted him to go back to the theater and tolerate spending more time with friends. And the other thing is his daughter had moved to Milan and he wanted to go visit her but he wasn't, he wasn't prepared to travel because he was worried about his symptoms affecting that holiday, that trip. And so, what we thought we would do is on that TV screen, we gave him a video of Milan to work with. So, we built up to this cause this is quite busy. So I started off, you can get Peloton videos that are in 4K. And so we just started again, him walking around quieter city than Milan.

'Cause you've seen Milan's very busy. There's lots of color. Let me skip to an interesting bit, maybe. Let's try here. So, you can see here, this is quite a busy

environment. There is a bit of hubbub on the horizon as well, which you know, isn't nice for them. It's almost like, it's a bit of an awful lot here that you are giving them through the vision. But, what you are trying to do is down weight all that information that's coming in through the eyes. You want the brain for almost disregard it and make it background noise again. So, he spends a bit of time building up to being able to look at a video like this.

But we got him there. And he successfully went to Milan and enjoyed his trip. But he did say that this video helped him. And a big reason why he thinks this helped them 'cause it helped him orientate him around the city. He studied maps as well, before he went. But the fact that he could orientate himself, took kind of that spatial awareness and that anxiety off of him as well. So, Fiona. Fiona is a tricky one. So, she presented with continuous non-rotational dizziness. But then she had episodic dizziness that was provoked by driving anxiety. So, some of you might have heard of motorist disorientation syndrome. So, there's definitely some overlap with motorist disorientation syndrome and visual induced dizziness for sure.

And if you read about motorist disorientation syndrome, it's kind of, when there's a mismatch between the otolith organs, so your acceleration/deceleration organs, and the information that's coming in through your eyes. She stopped completely driving, but there was a problem with that cause she lived in the countryside miles away from anything. So, it was very isolating for her not being able to drive. She was diagnosed with the left vestibulopathy by the consultants that I work with. And we were monitoring her for a PPPD, 'cause she downplayed her anxiety. She was one of those. Her DHI was 62. She had visual vertigo scores of five or plus. So, the higher end all the way through, but it was driving that she said was mostly her trigger.

So, what we did with her was we did some cognitive therapy with her first. And then she had three sessions of traditional vestibular rehab just to kinda strengthen the VOR

et cetera. And then she starts some virtual reality at home. She was another COVID patient. And, very similar to what we did with Paul, so she had the walk on videos, we built them up to bigger cities. Then we built them up to, she liked space so she would start, she was watching a lot space, the NASA stuff through them. And there was some National Geographic and walking kind of trek games that you can get as well. So we did that with her. And then she brought herself a full system with the drive and wheel, and she started working on the driving Sims with the goggles.

And so this took, about three months with the, with the simulator and then with the physician's approval, she started doing very, very short journeys just with her husband in the car. And then she gradually built up. But we are four, five years, sorry, no we're not. We're three years down the line and she's been, she's been pretty well since. So, there are just kind of three interesting cases that we've got through our clinic. But we are repeating a lot of this stuff and we are seeing very good outcomes and hopefully we'll get it published soon. Okay. So, let's just think about some tips. So, patient tips. So, you wanna make sure that they are not avoiding anymore.

So, you wanna try and give them the strength and the tools to not avoid the situations. But also, make sure that they are not gonna overdo it. So, they need to have small tasks and goals. And making smart goals is really, really important. It helps you work towards something and build gradually for your management plan. Try and limit leisure screen time because that means that your therapy time with the screen is more effective. If they have to work or have to use their phones, can you do things to help them minimize the contrast on their screens? So, you can do that just by going in the settings,, taking off blue light, sorry. Yeah, putting on blue light filters, sorry, excuse me.

Make sure that there's rest time and we teach them grounding as well. So, that they can ground themselves before they move on. Mild to moderate discomfort is always expected during rehab. Just like traditional vestibular rehab, it's very slow there. It is

very, very slow. And so it is that your expectations are called in may so you're not promised that within two weeks, they're gonna be better and back to life. I usually tell them to expect to do quite a bit of work and it's probably gonna be around six months before they, they really start to feel better. But, I do say that with most of these patients, we should be able to get them pretty much mostly back to where they were about 90% of where they were before.

Any resources you can get them from emotional trip triggers and don't overwork the system. So, here's just to show you where you can put the blue light filters on, so, on the left there, that's Android. So, you would drag it. And in where you put your Bluetooth on, you'll see the blue light filter. If you have an iPhone, you can put it on a permanent night shift. This is actually got an older screen though. I think you can actually do blue light filter as well, on that. But keep it on day shift. And then, you know, if they are really, really struggling you can get them the yellow filter glasses for if they have to, you know, if they have to sit at a computer at work all day and they have to just get on with life and they can't take six months to recover, that might be something to help them with their eyes, if they don't have much control over their monitor at work.

So, my tips for you as clinicians, always assess the visual vertigo in your history. I don't think you have to do the full visual vertigo questionnaires for every patient, but have one or two questions within your general history to kind of trigger that conversation if it's appropriate. Use your outcome measures for monitoring if you're gonna do rehab with them. Set expectations for slow but gradual improvement. Make sure you're goal orientated. If you're using virtual reality, try and work in a real world environment first. What do I mean by that? I mean, supermarket. Try and get them in a real supermarket first, if possible. But if not, then you can build their confidence by using a supermarket app with the virtual reality.

And small burst of stimulus initially, but then you should be able to increase in time over time. Change and increase it and avoid overloading. So, there's my references. I think I'm pretty much finished. So, thank you very much. I hope that was a help. And I'll be happy to take any questions which I think, should be in this little hub here. Let's look.

- Thank you very much, Amy. Thank you very much, Amy.

- Thank you.

- I truly hope you all enjoyed this fantastic learning opportunity. So, it's time for questions from the audience. But first, Dr. Armato would like to ask Amy some questions himself. So, I leave the word to Enrico first, and to our fantastic audience, later. Thank you so much again.

- Hi.

- Hello.

- Thank you very, hello. Sorry for, Anna is great. Thank you very much, Amy--

- Thank you.

- For your presentation. Before leaving the word to the audience, I would like to ask a couple of questions. Thank you very much.

- Of course.

- You know that I am a very interested in vestibular neuritis, and have you not noticed that how visual dependence evolves based on vestibular compensation?

- Yeah, so... So, with vestibular compensation, what happens is the... So when we have proper balance, you have equal and opposite signals coming in from the ears, right? And so, that is then integrated with the vestibular nucleus.

- Yes.

- And if everything's symmetrical, it's all happy and it all functions fine. When we have an acute insult like a vestibular neuritis, we lose the information coming up off from the hair cells at the ear, don't we? So, we get an asymmetrical response. And so, at the vestibular nucleus level, you also get an asymmetrical response and that's what makes them dizzy, right? And so, when it comes to the signals that are coming up from the ear, over time and with vestibular compensation processes and the connections between the two vestibular nucleus, it knows that you're getting an inappropriate signal from one of the ears because of the signals that are coming from the eyes and the body. So, that's where it downweights the information that's coming from the ears, and it upgrades the information that's coming from the eyes.

- Sure.

- So, if we close our eyes and we have normal function, we don't topple over because we're ear driven. But this is why patients can feel dizzy if they've got peripheral problem, they close their eyes because you are taking the vision away. So, they become eye lead instead of ear lead.

- Excellent, thank you very much. And what is the most challenging type of patient to treat, in your opinion?

- Okay. That's a good question and actually someone has written in, in the questions, is this contraindicated in migraine patients? So, migraine patients are the trickiest. We do still do therapy with them, but we are very careful with it, we take our time with it. If they are receiving medications for the migraine, we let that feed in first before we even start exploring virtual reality, sorry, visual therapy. And we do have some patients who can cope with the virtual reality. But again, it's a very monitored, very, very step-by-step process. I would never recommend having a migraine patient come in and then you stick them in front of the big TV or stick goggles on them. It's probably not a good idea.

- Thank you very much, again. And now the word to the audience. Thank you very much.

- So, I can only see one question but I do know another question popped up before. And it was just asking about slides, which I think Anna will put them on the audiology page. I think you will be able to access the slides. With migraine, does it usually decrease activity and the offer system load. Yes, that's a very good comment. It is, of course. It is. But... So, my fear around migraine is kind of triggering a migraine and that's why, sorry, there's a couple of questions jumping at the same time. So, my fear around vestibular migraine is that you don't want to trigger vestibular migraine. But at the same time, you also wanna help them if they are avoid, You don't want 'em to decondition anymore.

So, and a lot of migrainers can get better. You don't have to have migrainers on your books for a long time who are very, very poorly and triggered so much. So, we just really take our time with it. But they also need to speak to the patient as well. So, the patient comes in and they tell you they are light sensitive, they've got sunglasses on and they, that is the way they are, you have to approach that very, very gently. And so

those patients, we probably don't do much of the visual work with them. We kind of stick to the traditional vestibular rehab, and we stick to the traditional vestibular rehab and the medication to help them with the migraine.

Diet as well. Diet, exercise, that type of thing. So, other question, is there much difference in effectiveness between using TV screen and using headset? Very good question. So, we are looking into this. I don't have a big enough cohort to say for sure. But, I would say we are having more, it does seem to be more effective objectively, as well as subjectively. So, think back to the vHIT and the SHMIPS that I showed you seem to be more effective with the oculus. But, watch this space. Any other questions? So, I think that's all. I think that's all the questions. I'm not very clear on the questions cause they keep jumping up and disappearing again. So, I hope I've got everybody's questions. Okay. Thank you very much everybody.

- Amy?

- Yes.

- To be honest, I can see a lot of questions from the audience.

- I can see a sign of Q, and I can see, Is there a difference between TV and the headset? Do you want to read some out?

- Yeah, absolutely. So, Simon, Mary, Simon, again. Thanks Simon, for being here with us today. Simon asks, although problematic for the patient, could visual induced dizziness be the best adaptation?

- Ah, okay. Yeah. So, it's the automatic adaptation is what the brain intuitively does, right? It upgrades information of the visual system to compensate. So, it is all, yeah, it

is. But then what you are trying to do is then almost desensitize that overweighting of the visual system. Hope that answers that question.

- Fantastic. Then Amy, Mary Connell. Mary said, Hi Amy, lovely to see you again after the online vestibular diploma.

- Hi Mary.

- Okay. So just wondering, if virtual reality is contraindicated in migraine patients?

- Yes. So, I think we've talked about that before. So, just be, It's not a full contraindication, but you have to be very, very, very, very careful. Just, yeah.

- Okay. Mary, again. Is there much difference in effectiveness between using TV screen and using a break headset?

- Yeah, so we've answered that one too. So, there is no research to say so. Anecdotally, and what we're hoping to try and publish in ours is that it looks like there is, it's more effective with the headset than the TV screen.

- Okay. I think that's all. Enrico, other question for our lovely Amy Lennox?

- Thank you very much. For me, it's perfect. Congrats again, Amy.

- Thank you.

- Congrats, Amy. Congrats.

- Thank you. So Amy, thanks a lot for this fantastic learning opportunity. For the audience, you will receive soon a survey. I kindly ask you to fill out. The survey will help us to understand your needs and your suggestions. And I hope the lovely Amy Lennox could make herself available for future events we will organize. It will be a great pleasure for Inventis to have you, Amy, as a speaker, again.

- Thank you. I really appreciate you having me. Thank you very much. And thank you everybody who's logged on watch. Thank you, very much.

- So, the course is over, but Inventis Academia does not stop. I'm working on the webinar program for the next 2023. A lot of news, a lot of wonderful opportunities for in-depth study. So, please keep checking in Inventis social media pages and to register for future events promoted by Inventis Academia. Thanks again. Thanks Amy. Thanks Enrico.

- Thanks Anna.

- And have a lovely evening or afternoon or morning depending on the country you come from. Bye-bye.

- Bye-bye.

- Bye. Bye, bye, bye.