INTERVIEW TRANSCRIPT

DISCUSSIONS WITH WORLD-LEADING EXPERTS

Is Migraine a Sensory Processing Disorder?

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Introduction (00:04): Many people with migraine describe light, sound, motion, and even smells as painful or overwhelming. Is migraine at its core a problem of how the brain processes sensory input? And if so, what can we do about it? Today, we're joined by Dr. Amaal Starling from the Mayo Clinic to unpack the science and day-to-day strategies that help. Dr. Starling, welcome back to the Migraine World Summit.

Dr. Starling (00:28): Thank you so much, Carl. I always love being at the Migraine World Summit year after year, so I'm excited to be here again. And a very exciting topic.

Carl Cincinnato (00:38): Well, we love having you. Dr. Starling, what is a sensory processing disorder and how is it usually defined?

Dr. Starling (00:44): Yeah, so a sensory processing disorder — or sometimes it's actually referred to as a sensory processing difference, if it does not meet the threshold of a disorder or resulting in abnormal function — but in the most general of terms, what it is, is all the different sensory stimuli that are coming into our body from our external environment and even from our internal environment, from inside of our body.

Dr. Starling (01:13): When that stimuli are not being processed in the normal pathways and the normal function, then that can result in a difference or a sensory processing disorder. And it doesn't just mean a hyperresponse to stimulation, but actually it could also be an underresponse to stimulation. So there may be individuals who, to touch, may jump. Or individuals where, to touch, you have to rub them more and more before they're able to sense that you are touching them.

Dr. Starling (01:48): So it could either be a hyperresponse to sensory stimulation or it could be an underresponse to sensory stimulation. I also think it's important to think about what sensory stimuli are we talking about because it's not just the five sensory stimuli or sensations that we learned about, way back in grade school, right? Our sight, our hearing, our touch, our smell, our taste. But also, what about our vestibular stimuli that we get? What about motion?

Dr. Starling (02:26): Are we processing motion appropriately? There are individuals who may feel like there's constantly this abnormal sense of motion when they truly are still. What about proprioception? This is the sensation that we have that we know where our body is in space. And that may be differently processed in certain individuals. Interoception, meaning the way that we are responding to our internal stimuli — hunger, thirst, temperature, all of those things.

Dr. Starling (03:01): And then the last one, which is very important, especially for the topic of migraine, is nociception, or pain perception. So those are all the different stimuli that could potentially have a hyperresponse or an underresponse resulting in a sensory processing difference or a disorder if it's resulting in dysfunction.

Carl Cincinnato (03:25): Does that cover the five senses?

Dr. Starling (03:28): We've got our five senses, but we've got more. That's what it covers, right? So we've got sight, hearing, touch, smell, taste, but we also have motion. We have where our body is in space, which is called proprioception, thermoception — our temperature, and then also pain. So it goes even beyond just those five senses.

Carl Cincinnato (03:51): I guess it brings a whole new appreciation to someone with migraine when you've got the five senses that everyone knows about, but also these other senses that when things are working normally, you don't really notice. But in migraine and conditions like that, we do notice them and they can become painful or sometimes debilitating in different ways.

Dr. Starling (04:11): Exactly.

Carl Cincinnato (04:12): Should people with migraine think of migraine as an official sensory processing disorder, or is it more a neurological condition that includes sensory processing differences, problems, or disorders?

Dr. Starling (04:26): I think that as we have an understanding of what migraine is right now, and what we know about migraine is that it has a genetic cause, right? So it's a genetic neurologic disease that has many internal and external factors that influence the severity of the disease, as well as just the prevalence of the disease — a person having it or a person not having it, whether they have the genes or not, can depend on all of those factors.

Dr. Starling (05:01): And in people with migraine, there is abnormal function of the brain, and the abnormal function of the brain is this abnormal sensory processing. So I don't think migraine as a field has yet defined itself as a sensory processing disorder.

Dr. Starling (05:20): However, definitely as a field — from a clinical perspective, and from a clinical trial and scientific perspective, and an anatomic neuroimaging perspective — we have evidence that shows, an overwhelming amount of evidence that shows that the abnormal function in migraine is abnormal processing of sensations, not just pain, right? In the migraine world, we always say: It's not just headache. There are so many other symptoms that are involved in migraine.

Dr. Starling (05:55): And that's why it's an abnormal processing of all these different sensations that's resulting in the clinical phenotype of what migraine looks like in individual patients.

Carl Cincinnato (06:06): Do we know why there's abnormal processing of these normal stimuli like light, noise, and smells? Why can they feel so intense or painful for people with migraine?

Dr. Starling (06:16): We know why it happens to a certain degree from some clinical trials that have been done. So if we're asking why is it happening based on the science, we know that there have been what we call electrophysiologic studies that have been done. And in these studies, we are looking at the electrical response to sensory stimulation. So for example, if someone is given some certain visual stimulation, there's a specific brain electrical response, a visual evoked potential, that we can measure.

Dr. Starling (06:51): And we know that in individuals with migraine — whether they're having an attack or even *in between* attacks, so interictal, meaning when they're not having a migraine attack — that they have a different response, a different electrical response to that sensory stimulation or that visual stimulation.

Dr. Starling (07:14): We also know that in individuals with migraine compared to healthy controls, when we expose someone in a healthy control to the combination of touch *and* light together, versus migraine, it is processed abnormally and differently in those individuals who have migraine. There's also something else called a habituation deficit that is present in individuals with migraine.

Dr. Starling (07:42): So clinically what that means is, in individuals who don't live with migraine, if they're in a room where there is a light that is slightly flickering, they may notice it when they first enter the room, but guess what? Their brain habituates to it, and they no longer notice it. You walk into a room and you may hear a slight hum, but in an individual not living with migraine, it'll just cancel out and they no longer hear it.

Dr. Starling (08:10): However, in individuals with migraine, they don't habituate to that repetitive stimulation. It is constantly fresh and new and intrusive and potentially painful for those individuals.

Dr. Starling (08:23): And that's also been demonstrated in the laboratory level as well with different blink reflexes where if you're giving someone a stimulation near their eye and a protective reflex is to blink; but if you continue that stimulation and the brain learns, “Oh, this is actually not going to be dangerous,” individuals without migraine will stop the blink reflex. But individuals living with migraine, they can't habituate to that.

Dr. Starling (08:48): And so there is this difficulty with habituation, which again, is sensory processing abnormalities. Now, I also want to touch on a maybe more philosophical question of: Why does this even exist, right? I was just talking to one of my trainees about how is it that migraine is so disabling, right? One of the leading causes of disability. However, it is so prevalent and usually, through evolution, things that are very disabling are not very common.

Dr. Starling (09:25): But you can think that maybe in the caveman and cavewoman days, having migraine and being hyperresponsive to your external and internal environment was actually a survival tool. And maybe we were the survivors. I say “we” because I have migraine myself. And so maybe we were the survivors because we knew when there was a weather change coming. We knew when the light was getting less and we needed to get to cover because darkness was coming.

Dr. Starling (09:57): We knew when there was danger that was far away because we could hear it, we could see it and you're hyperresponsive to stimulation. So there you go. I gave you a philosophical answer and a scientific answer.

Carl Cincinnato (10:08): I like to think that we do have a few, perhaps unwanted superpowers, right? We might be able to smell the tiger or the lion or the gorilla because we can smell them and the other people in the village can't, and so we can run away faster or not be the last person.

Dr. Starling (10:25): Yeah. Carl, I actually tell my patients that, you know, that “You're a superhero that is no longer exposed to all of those dangers. And so now we need to try to normalize some of that abnormal function so that you are not constantly living in this hypervigilant state.”

Carl Cincinnato (10:44): Migraine we know is a condition that affects a lot of people differently and in terms of severity as well. Does that also suggest that as migraine becomes more chronic and more frequent that these sensory processing difficulties become more pronounced?

Carl Cincinnato (11:01): And then likewise, if we perhaps improve or we reduce our frequency of attacks or maybe we become episodic and we go into remission from chronic migraine, does that also show that perhaps our sensitivity to some of these sensory processing inputs — or at least the processing mechanisms can improve as well?

Dr. Starling (11:23): Yeah, such a good question. And it really kind of refers to the plasticity of the brain and how much can we wire up that sensitivity of all of those pathways, or really the gain, right, the amplitude of all of those pathways. And then can we actually go in the opposite direction? And what is beautiful about the brain, it is very, very plastic. The plasticity of the brain is what leads to chronification and transformation, right?

Dr. Starling (11:55): Frequent attacks that are untreated or at least unoptimized in their treatment can lead to chronification. It can lead to strengthening of all those pathways.

Dr. Starling (12:08): And we now have evidence that shows that in neuroimaging studies, that we're able to differentiate in functional neuroimaging studies healthy controls not only from migraine, but also look at the spectrum of migraine and differentiate function in episodic migraine, high-frequency episodic migraine, chronic migraine — even to the point of actually seeing some microstructural changes in the brain as well, in addition to the functional changes.

Dr. Starling (12:41): And what we're hoping to see is that we'll eventually have data that shows that we can reverse those processes. Now from a clinical perspective, we do know that in many individuals we are able to reverse those processes. But honestly, my approach would be preventing getting to that point in the first place, which is why our focus is on screening, on a diagnosis and an early treatment. And migraine in many individuals starts when individuals are children, right?

Dr. Starling (13:12): So really increasing the focus on screening and diagnosis, and optimization of treatment of migraine in pediatrics is hopefully going to reduce the chronification of migraine that we see in many adults.

Carl Cincinnato (13:28): Some patients describe allodynia — when touch itself becomes painful. Do we know what's happening in the brain when that occurs and why does that matter?

Dr. Starling (13:36): Yeah, so allodynia is a biomarker for what we call central sensitization. So first of all, allodynia is when nonpainful touch becomes painful. And this can be present in individuals with migraine during an attack. We also have data that shows that even in between an attack—interictally — that people can experience allodynia as well. And the allodynia can be present on the head and neck area, but also can be extracranial too, even on the body, anywhere on the body.

Dr. Starling (14:14): I have some patients with chronic migraine — many, many years of chronic migraine — who will tell me they *feel* their clothes. This is another one of those concepts of a habituation deficit, right? In general, most people don't feel that they're necessarily wearing clothes because we habituate to it. But some people living with migraine, and who may have high degrees of that hyper-responsiveness to touch and may have a lot of allodynia, will even feel their clothes, and it's uncomfortable for some of the patients.

Dr. Starling (14:52): So what is central sensitization? It is when those brain pathways are really strong, that pain matrix has become really strong. I think about the pain matrix kind of like a muscle. And we go to work out at the gym and we exercise to strengthen those muscles. What strengthened those pain pathways is recurrent migraine attacks, especially when they're untreated or poorly optimized in their treatment. Those pain pathways become very strong. There is a process of central sensitization that occurs and that is what can lead to things like allodynia.

Dr. Starling (15:28): And it's important to identify allodynia in patients because we know from a treatment perspective, there are certain medications that can reverse allodynia and there are certain medications that may not work as well when allodynia is present because they don't reverse allodynia. So that may help me and my patient come up with a shared decision treatment plan for their migraine attacks.

Carl Cincinnato (15:53): I think it was Richard Lipton who said pain begets pain. So it's just another reason why you don't want to let recurring painful migraine attacks that are causing disability and debilitation to go unchecked.

Dr. Starling (16:06): Yes. I'm glad that you said it like that. And I want to reiterate that statement to the Migraine World Summit audience because it's so important. People who live with migraine have an incredibly high pain threshold because you are experiencing pain and discomfort at such a more frequent level than the general population. And so a lot of my patients will come to me and they're like, “Well, I don't want to take a medication because I'm just going to deal with the pain. I just want to make sure that I didn't have a brain tumor,” or, “I wanted to make sure I wasn't having a stroke or an aneurysm, but I don't want to take a medication.”

Dr. Starling (16:49): And maybe this is an individual who has four or five migraine attacks per month. And so for that individual, it's important for me to provide the education that we have data that

shows that when you have four or five migraine attacks, and if we don't treat those appropriately, that can lead to disease progression.

Dr. Starling (17:15): So I want you to treat your migraine attacks not only because I want to reduce your disability and your function for the individual migraine attacks you're having right now, but I also am looking at migraine as a progressive disease. And if we don't address your migraine attacks now, you actually have a higher risk of transformation to chronic migraine in the next year.

Dr. Starling (17:39): And explaining migraine and migraine treatment and intervention in that way has really helped a lot of my patients say, “Oh, OK, there are more reasons than the symptoms I'm having right now to treat my migraine because I don't want to have chronification of disease. I don't want things to worsen in the future." So that's been really helpful for my patient population.

Carl Cincinnato (18:04): Yeah, and it can be a slippery slope from episodic to chronic.

Dr. Starling (18:08): Yes. And then it's harder to go back, right? We know chronic migraine can be more challenging to treat than episodic migraine for the vast majority of individuals living with migraine.

Carl Cincinnato (18:19): An ounce of prevention is worth more than a pound of cure.

Dr. Starling (18:22): Exactly.

Carl Cincinnato (18:23): Sensory processing differences are also common in conditions like autism and ADHD [attention-deficit/hyperactivity disorder]. How is migraine similar and how is it different?

Dr. Starling (18:31): Well, one of the things that's similar is that they often coexist together, right? So if you look at populations with autism spectrum disorders, there is a higher percentage of individuals with migraine compared to the general population. Same applies for ADHD. Same applies for a lot of other disease states where there is abnormal function.

Dr. Starling (18:58): Pain states like fibromyalgia, there can be other — even abdominal pain, functional dyspepsia, a lot of those other conditions that involve abnormal function are comorbid with migraine. So what does that mean? I think we haven't yet uncovered it all, but obviously there's going to be a genetic overlap that we will eventually discover. The genetics of migraine I feel like are still quite a bit in its infancy.

Dr. Starling (19:31): What we have now are over a hundred different genes with over hundreds of different genetic variations that can lead to genetic vulnerability to migraine disease. And many of those genes likely overlap with some of these other sensory processing disorders or differences.

Carl Cincinnato (19:50): We also know that migraine is more common in people with these conditions. What does the research show about these overlaps and why they may exist?

Dr. Starling (20:00): Yeah, so I really think it comes down to the genetics and what those genes are doing to the function of the brain. And so, in individuals with autism spectrum disorder that's resulting in abnormal sensory processing, those genetic abnormalities are leading to that abnormal sensory processing and there may be shared pathways with individuals who have migraine.

Dr. Starling (20:29): But then in individuals with migraine, they also have shared genetic pathways to individuals with chronic pain conditions like fibromyalgia. And so, there's likely a lot of different overlaps, which is why there is so much; the amount of genetic heterogeneity, or differences that exist in all individuals living with migraine, is why migraine looks so different in its clinical phenotype in person to person.

Dr. Starling (20:57): It also explains why there's not a one treatment that addresses all individuals living with migraine, because everyone's migraine disease is a little bit different.

Carl Cincinnato (21:07): It seems as well in ADHD and autism, that these changes tend to occur in early development, like in childhood, and they seem to be relatively fixed throughout their life. They can learn tools and they can have treatments and so forth, but it's fairly inflexible; whereas with migraine, it feels like these sensory processing differences can come and go along with the severity and the disease progression or improvement a little bit more. So there's in that sense for migraine, there's quite a bit of hope to have in regards to managing.

Dr. Starling (21:44): That is so true. And it's so important to talk about how you can go in both directions. And often, it's just human nature that if something is uncomfortable, you want to avoid it. So I have patients for whom light is very, very uncomfortable because they have a hyperresponse to that visual stimulation. And sometimes in those individuals, as their disease progresses, they may avoid light more and more and more.

Dr. Starling (22:24): But unfortunately, our brains and our sensory systems are built to seek out sensory stimulation. And so, as someone is avoiding light, the sensory gain on those light pathways is actually increasing. So as they're avoiding light, they're becoming more sensitive to light.

Dr. Starling (22:47): And so, we often have to really do a desensitization therapy for some of these patients — an exposure therapy where they bring them back into light slowly over time to try to normalize those gains at the same time that we're trying to treat all the other abnormal function of the brain with all the tools that we have in our toolbox.

Dr. Starling (23:09): But we have a program here, our Chronic Pain Rehabilitation Program, which really is about bringing a lot of my patients who have chronic migraine, who are living in the dark and in the quiet, back into the light and back into the normal sounds, ambient sounds that are present — so that hopefully we're able to reverse those processes of hyperresponsiveness. Avoiding it makes it worse. We really need to try to normalize function of those areas, but then also desensitize the spaces.

Carl Cincinnato (23:46): That was actually something that's so relevant for me personally with light sensitivity and with having migraine with aura. I'd just have the light sensitivity at least for a week after an attack and I'd be exactly, just afraid of the light. I'd literally have photophobia.

Carl Cincinnato (24:06): And I think it's also true for exercise as well. A lot of people in our community will say that exercise triggers migraine. Yet we know exercise is so beneficial for the brain, so beneficial for stress, so beneficial for sleep, that if we can unlock that ability to get exercise and movement without feeling guilty and placing blame on people who are generally struggling with this, that it can have really great benefits. But you're right, it is gradual.

Carl Cincinnato (24:33): You could have in the exercise space, it's like, give yourself a really generous warm-up, be conscious of exercising in the sun, be aware of getting hungry, dehydration. There are all these factors involved. But if you can gradually, slowly, starting with a walk around the block, perhaps build up, it can have those benefits.

Dr. Starling (24:52): Yeah, you're exactly right. Exercise is such a great example. And one of the things that people can be aware of, or senses that people can be aware of, is just postural changes. And I find that a lot of my patients with migraine are very hyperresponsive to postural changes where being upright is uncomfortable for them. And then it results in them being not upright, and really being bedbound frequently.

Dr. Starling (25:22): And that actually ends up having a lot of deconditioning challenges that worsens the picture. But I've found that from an exercise perspective, is that if we can explore how

can people exercise without forcing themselves to be upright by doing a lot of recumbent exercise, where we can start with recumbent bike, or we can start with water exercises, which seems to really help. I think because it provides a good amount of sensory stability, right.

Dr. Starling (25:52): When you're in the water, you have, it's almost like a full body compression with the water. But I find that my patients with migraine do well with starting with water exercises and starting with recumbent exercises, even strength training, again, in the recumbent position. So figuring out a way to be able to engage in that therapeutic aspect of exercise in a way that doesn't increase discomfort is something we really work with our patients on.

Carl Cincinnato (26:21): What are some of the most useful environmental changes for people around light, sound, smell, and motion?

Dr. Starling (26:27): The biggest thing is stability, right? You want to try to really reduce the amount of changes that you have in your external and your internal environment. Now, that's hard because that means that I'm telling my patients to basically live in a bubble and not do anything. And that's obviously the exact opposite of what I want my patients to do. But I empower my patients to think about migraine as a threshold disease, right?

Dr. Starling (26:59): And all those different internal and external factors can affect that threshold. And they have control to modulate some of those factors. So, for example, if there is a change in weather, well, that's not something that we can change. But if there's a change in weather, the threshold drops. But if people know, like right now, in — I'm located in Scottsdale, Arizona — and in Arizona, we're in monsoon season. And during this season, there's a lot of barometric pressure changes.

Dr. Starling (27:30): And for my patients with migraine, this is a vulnerable time period for them. So their threshold is lower. But this is the time where they can optimize stability in their sleep schedule, optimize their eating schedule, optimize their hydration, optimize their regular exercise. And those things will help actually raise that threshold so that they can build some more stability back into their day-to-day environments.

Dr. Starling (27:59): And the same applies with really all of those things that people feel might be triggers for changing that threshold and vulnerability of having their next attack.

Carl Cincinnato (28:09): We have another talk this year talking entirely about vestibular migraine. But for people who experience dizziness and motion, is that a sensory processing disorder, and what approaches can make a difference there?

Dr. Starling (28:20): The vestibular senses is another one of those five-plus senses that we have. Having good vestibular sense is knowing that my body is not moving when it's not moving. Knowing that my body is moving when it is moving. Knowing that the environment around me, if I'm sitting in a car and I'm driving, that the environment around me is moving.

Dr. Starling (28:45): Knowing that, or if I'm not driving in a car and I'm just sitting there parked in this parking lot and knowing that it's not moving — all of those things are senses. And individuals who have vestibular migraine have abnormal processing of that sense of motion. They may feel like they're constantly moving. They may have an internal sense of motion or even an external sense of motion. So it's very similar.

Dr. Starling (29:13): I actually lump it together when I tell people about migraine. I say, “Migraine is not just about pain, but it's abnormal processing of all of the senses — light, sound, smell, motion.” Because even people who may not meet criteria for vestibular migraine, they may have vestibular

symptoms or dizziness associated with their migraine attacks. And definitely in people with vestibular migraine, those vestibular symptoms are very, very prominent and very disconcerting.

Carl Cincinnato (29:49): And I've noticed, like for me, they've changed over time. I've become, for example, much more sensitive to seasickness as I've gotten older, which is something I've noticed with quite an amount of displeasure, unfortunately.

Carl Cincinnato (30:03): But we hear from our communities that as they get older and perhaps as their pain — like the head pain element of the migraine attack improves — the vertigo and dizziness kind of rises to the fore, and it can be just as, if not more, debilitating than the attacks were in the past.

Dr. Starling (30:22): You know, there needs to be so much research in that timeline because clinically, I see it as well. In fact, a large cohort of my patient population are individuals who present after they've gone to maybe two or three or seven ENTs [ear, nose, throat clinicians] because they're dizzy. And these are often women that are in their 40s to 50s, so around that perimenopausal time period where they will actually develop vestibular symptoms.

Dr. Starling (30:54): And when they come and we do a full history, these are often individuals who have had a history of migraine that has been undiagnosed their entire life, but now their migraine symptoms are associated with more of these vestibular symptoms, plus or minus pain. Some of them don't even have any pain associated with it. Some of them may have more mild pain, but the vestibular symptoms are what's most disconcerting.

Dr. Starling (31:20): I see a lot of those patients and they're so worried that there is something that is more alarming from a structural perspective that is resulting in the symptoms that they have. The good news is, for the treatment of vestibular migraine, in general, they respond to a lot of our general migraine treatment options.

Dr. Starling (31:44): And we even have some studies with our novel therapeutics specifically for vestibular migraine with some of the CGRP-targeted medications, which have had good results in those patients.

Carl Cincinnato (31:56): That's a great lead-in to talk about treatments and management strategies. So is it fair then to say that if we get a treatment that reduces our migraine attacks, we can expect it to help, at least to some degree, with our sensory overload as well?

Dr. Starling (32:08): Yes, we're really trying to reverse that process of central sensitization, and often central sensitization is only talked about in the processing of pain, or nociception. However, I'm broadening that definition of central sensitization, not just to pain, but also to light, sound, smell, motion — all of those five plus senses, right?

Dr. Starling (32:38): And so with treatment, our hope is all of those things will improve, and that we raise that threshold so that individuals are allowed to live the life that they want to live. And they may have some exposure to different external and internal triggers, but it doesn't reach the threshold of triggering a migraine attack.

Dr. Starling (32:58): Now, we don't have a cure for migraine. So in addition to always having preventive treatment options to raise that threshold, every person with migraine should also have rescue treatment options for when that threshold is overcome and an attack occurs, that we're able to treat that attack effectively and rapidly.

Carl Cincinnato (33:20): You spoke earlier about neuroplasticity. Beyond medication, are there skills or habits like sleep, exercise, mindfulness, that can actually raise the brain's tolerance to sensory input over time?

Dr. Starling (33:31): Yes. So there are so many nonmedication and even nonprocedural things that can be done from a treatment perspective for migraine. So I always talk about the SEEDS for success in migraine management. That's Sleep hygiene, Exercise, Eating regular healthy meals, preventing Dehydration, and then Stress management. What I mean by stress management is really coping skills. We all have stress. I never tell my patients, "You need to get rid of stress in your life."

Dr. Starling (34:03): I was told that when I was in college and I thought it was a silly recommendation myself. So I don't say that to patients. But really, it's learning how to cope with stress. There are studies that have shown cognitive behavioral therapy [CBT], biofeedback, progressive muscle relaxation, mindfulness — all of these therapies can be very, very helpful from a preventive perspective.

Dr. Starling (34:26): And some studies that show that even during an acute attack, biofeedback or progressive muscle relaxation can be helpful to stop an individual attack. What's interesting is, we started this conversation about the overlap between sensory processing disorders like autism spectrum disorders, ADHD, fibromyalgia — all these different disorders where there's abnormal processing of sensations, including migraine.

Dr. Starling (34:55): And when you think about the nonmedication approaches of how we can treat migraine based on evidence, you see that there is actually quite a bit of overlap. A lot of those spaces can benefit from physical therapy, occupational therapy, exposure therapy, CBT or cognitive behavioral therapy, mindfulness — can be very helpful for all of those states, can really help people feel grounded to where they are in space and in their environment.

Carl Cincinnato (35:31): If someone's having an acute episode of migraine or just sensory overload, what's something that they can do to just try and sort of get through that situation to bring things down a notch?

Dr. Starling (35:45): Yeah. I think biofeedback is such an incredible tool that really all of us humans can optimize so that we can use that. When someone is in that place of sensory overload, it really increases that hypervigilance and throws that individual into a fight-or-flight mode. And when we are in fight or flight, we are even more responsive to all of the stimulation around us.

Dr. Starling (36:17): And it makes sense because if we were truly running from a bear or danger, we would want to be very sensitive to light, sound, smell, pain, everything around us so that we could survive.

Dr. Starling (36:30): However, in this state, when they have sensory overload and they can feel that they have initiated a migraine attack, it really is important to be able to not only use the tools they have available, whether they be medications or devices, but also use biofeedback to be able to modulate that autonomic nervous system. The autonomic nervous system is that fight or flight, and the opposite of it is the rest and digest.

Dr. Starling (37:00): So the sympathetic nervous system is the fight or flight, and then the parasympathetic is the rest and digest. And that should always be in a yin and yang, nice balance. However, in that place of sensory overload, our fight or flight is just up the roof, right? Through the roof. And so if we can practice box breathing techniques or other biofeedback techniques and paced respirations, that actually tries to normalize that balance between the fight-or-flight system and the rest and digest.

Dr. Starling (37:36): So using the tools that you have available, that you have established with your healthcare professional for the acute attack, but then also — be empowered to use all the tools that you have control over to try to bring back normalcy to that balance between fight or flight and rest and digest.

Carl Cincinnato (37:58): What's the most important message you'd like people to take away about migraine and sensory processing?

Dr. Starling (38:06): Well, the No. 1 message that I want patients with migraine to take away is that migraine is real. Migraine is a genetic neurologic disease that results in abnormal sensory processing in the brain. And it is also something that we can treat. And the sooner that we can get to diagnosis and optimize treatment, the faster that we can reduce the risk of disease progression. And the faster you can get back to the great life that you have.

Carl Cincinnato (38:42): Dr. Starling, thank you for your time and expertise today in covering a topic that we've never covered before on the Migraine World Summit. We greatly appreciate you joining us.

Dr. Starling (38:51): Thank you so much for having me again, Carl.