Introduction to Evoke Neuroscience

Welcome to The Parkinson's Solutions Summit. I'm your host, Dr. Ken Sharlin. In today's interviews with Dr. David Hagedorn. We go back several years when I became introduced or was introduced to a really indispensable piece of technology that I use in my clinic all the time.

and his company is called Evoke Neuroscience. The technology is called an Evoke test. And the way that I explain this to my patients is, look, when you get an MRI, we're looking at the structure of the brain.

But there's a whole other dimension to how we as human beings work, and that is function or physiology. And his test really gives me tremendous insight into the physiology or the workings or how it's not working.

Right. Because we call our programed brain tuneup how it's not working right. When it comes to the brain and to an extent, the heart, which I'm sure they'll touch on, Dr. David Hagedorn is the chief science officer and CEO at Evoke Neuroscience.

He also has a practice in, North Carolina where he. I'm sure he's probably visiting with me now. But without further ado, we're going to talk about this fantastic tool and how it helps people with Parkinson's.

Dr. Hagedorn, welcome to The Parkinson's Solution Summit. Thanks, Dr. Sharlin, it's a privilege to be here. And it's a privilege to be part of, your contribution to the science and education for not only your peers, professional neurologists, primary care, and your patients and people at large, because we want people to understand and be advocates for their own care.

EEG, Evoked Potentials, and Parkinson's Physiology

I'll give you a little just brief history. we started a company, because we needed a simpler solution to record objective data from the brain. The electrophysiology of the brain, EEG, the central nervous system.

But we also needed data about the heart because that's connected to the brain. so we're looking at EEG, something also called evoked potentials, which comes from the EEG.

And we use that to calculate processing speed and how the brain handles new information coming in. That's very important for Parkinson's. Also the heart is affected the autonomic nervous system with Parkinson's.

So this, this one, that one test is, an FDA approved process for EEG and ERP, and we use it to help in the differential diagnosis and tracking treatment and helping people target some interventions.

So when we think about Parkinson's, and I'm at this age point myself. So it's a little scary. 1% of those my age 60 and above. I have that's the prevalence of Parkinson's today.

It's a big, big number. in fact, it's the sick and leading neurodegenerative disease to Alzheimer's. So, very, very important. And we're seeing an increase, an uptick.

that's a problem. It could be from all the inflammatory processes that happen from toxins. There's a lot of reasons why. but we want to measure things early and we want to be definitive.

interestingly, EEG now is being found to be about 99% accurate in diagnosing Parkinson's. so it's, you know, it's kind of a shock, to this recent research in the last couple of years.

so, you know, that's why we're talking about this test today. it's noninvasive. It's office based. it's. You don't need a

radioactive isotope in your veins to do it.

so it just makes it inexpensive. So from a medical prudence standpoint, it just makes a lot of sense. And. Yeah, go ahead Dr. Sharlin. recently in the news, you know, of course, when we talk about Parkinson's, the focus tends to be on the motor symptoms, the tremor, the rigidity, the shuffling gait, so forth.

But there's a huge dimension to Parkinson's that it's non-motor. And of that, we talked about the cognitive dimension. There was recently, an article that came out.

We'll see if the data ultimately is supported in the long run, suggesting that perhaps we've been overestimating, the dementia component of Parkinson's, meaning how what percentage of people will develop dementia and at what point?

Maybe the dementia comes on much later than we were thinking. And certainly not everybody develops dementia, but the vast majority will develop. And this is my point.

Some degree of cognitive impairment and what I love about this test is it's kind of takes a microscope to the brain in terms of function and allows us to pick up some subtle changes in cognitive decline very early, which gives us opportunities for intervention.

Yeah. Yeah. Well, well, said Dr. Sharlin. You know, we always think about the motor and it would be bradykinesia, rigidity, static tremors, postural problems, you know, gait disorders.

as being kind of the signature symptoms. And indeed, those are I mean, early on, you definitely can see that. But there's also cognitive symptoms and also pain.

we don't want to ignore the pain component, and we don't have time to talk about the pain networks in the brain. But there are the medial and lateral pathways are involved.

so there's a relationship to pain processing too. so, you know, I'll just kind of touch on EEG first, maybe. And how that, applies. So EEG is just recording the electrical activity off the cortex of the pyramidal neurons that direct towards the top of the head.

We record that EEG. We then compare that EEG to a normal reference group to see what the differences from you to someone like you and age and gender with no symptoms.

what's nice about EEG, unlike MRI, is you can get great temporal resolution. And the difference? There is a fancy word, but it basically means it's a more, rapid measure of function versus a, like a, a snapshot that we'll look at.

So it's 4 or 5 seconds of activity time in your brain. So if you had a lesion or a bleed, you know other devices like CT, MRI or superior. But when you're looking at function, how does your brain do stuff every day at a millisecond level?

There is no better way than looking at it with, EEG. so that, you know, that's why we use EEG. And one of the, one of the other advantages is we can then see the type of electrical activity that's coming off your brain.

And there's a couple different signatures or biomarkers or endo phenotypes is another term. and one of them is a frequency called beta. It's a very fast frequency.

And it's over the motor strip right through here. And if you have that activity, that cortical overactivity it will cause motor muscle activity of course motor tremor.

And and you can see it very clearly. There are other signatures two I once called an alpha theta measure.

Heart Rate Variability and Autonomic Dysfunction

It's a measure of how slow your brain is going. So some parts of the brain say frontally or parietal, that will be slowing down compared to what a normal person would be would like.

And one of the reasons for this is, the Parkinson's condition causes dysfunction in the thalamus, the thalamus, processing of that part of the brain. So when we when we have, Lamarck dysregulation or we call it the oscillation effect in the cortex is abnormal, that oscillatory or rhythmic activity in the thalamus that's damaged with the decline in dopamine, which is one of the things we see with Parkinson's, is that dopamine decline.

And that affects the brain quite significantly. with EEG, we have, you know, some some very good mathematics, like independent component analysis, which allows us to mathematically, very cleanly look at what's going on electrically in a person's brain and find the location and the frequency where there's a problem.

Now, this is helpful beyond diagnosis. This is helpful for planning treatment strategies. Or if you're taking levodopa and carb dopa, which is a standard, you know, treatment for many people.

We can see the effects of that. Like, is the dose working? Do we need to change the dose? We can see an immediate response in the brain to the treatment and modulate AutoTrader dose accordingly to minimize symptoms, abnormal symptoms.

So it's another reason why to use it. and then, you know, and if you add another therapy, let's take a look at the brain. How does a brain handle that.

So great. Those are some advantages of what's called quantitative or digital analysis of EEG. Dr. Sharlin. That's what I definitely want folks watching this interview to understand is we use the term EEG frequently, and I do routine EEGs in my office.

If I'm evaluating some of these, say for epilepsy, this takes the EEG data sort of a step higher. Doctor Hagedorn, you use the term one to write a quantitative or, and, you know, analytical, where they can take the raw data and then extract out of that specific types of information.

Exactly. And that's a great segue to another thing we do extract from the EEG. So if you imagine you're recording the electrical activity in the brain, and then you present a stimulus to the body like a flash of light or a checkerboard, we can then extract, how does the brain deal with that new information.

And we call that event related potentials or evoked potentials. And that's one of the very interesting things that's unique to Parkinson's is how your brain takes in new data.

What does it do with it? Can it handle it quickly or can it not? Even visual processing evoked potentials are very sensitive to people with Parkinson's.

Where they don't respond well to the input is just tremendous delay or lag time, and how the brain processes data coming in. And you can't get that with just EEG.

You need the evoked potential data. So we talk about evoked potentials like P300 and this p300 A, which is the front p300 B which is higher order processing.

They're both part of the same measure of how the brain processes. And we know that those numbers change with the severity of Parkinson's, storing to do the regression of the condition.

And we can track with those numbers. But they also respond to treatment. And they're very sensitive in responding to treatment. So a P300 B is for example, you know, a delay.

So you it takes longer for you to process higher order information, which is one of the reasons memories impaired with Parkinson's. And as I mentioned, visual processing which is a sensory measure is impaired.

So we look at these ERPs, if you will, as another kind of view or angle view of the mountain. So you're looking up from the north side of the mountain with two EEG.

We're looking at the west side with very early potentials. And then we we still have more measures. We can use, for the autonomic. So ERPs are not a very helpful Doctor Sherman to the package.

And you know, I would say up until recently, neurologist typically used ERPs just for peripheral conduction measures where we're looking for how the how the information from a pain is processed in the brain through the spinal cord, through the nervous system.

That's a type of evoked potential that neurologists commonly use in practice when they're doing, peripheral nerve conduction studies. You've kind of alluded to the autonomic, and that's a big component of Parkinson's.

There is a test I I've never actually ordered the test. I don't even know if it's being performed. But if you look at the, diagnostic, the Movement Disorders Society diagnostic criteria for Parkinson's adjunctive, you can support that diagnosis.

in other words, this isn't by itself a test for Parkinson's. But if it's abnormal, it supports the suspicion that the person has Parkinson's. And that's the mid BGS tography of the heart.

And essentially for folks watching this, what's that. What that does. It's a it's a nuclear medicine test that, is in which that individual gets this medicine through their vein. Ivy.

And normally if the heart was healthy, it would essentially light up what's called the sympathetic nervous system component of the heart. But because we know in Parkinson's, those nerve fibers have often deteriorated.

Essentially, you would have a negative test instead of a positive test. A positive test would be normal. You'd have a negative test reflecting a loss of those, and that essentially fight or flight fibers so that folks understand.

So this is really interesting to me because a big component, I find of using the Vox test is a measure of what's called heart rate variability. And I'm sure Doctor Hayden explain it more.

But the point I want to get to here is that, oftentimes when we see abnormal hrb in general in our clinic, it's much more dominated toward the sympathetic side that the brain is in fight or flight.

And yet at this and while that wouldn't be expected in Parkinson's, and we've done some independent confirmation of that in our clinic, what is interesting, though, is that hand-in-hand with this loss of sympathetic nervous system innovation is that people with Parkinson's often feel very anxious, which I think is so interesting because it sort of says there's a disconnect between the brain and the heart and wonder if you had any thought about that.

Yeah, that's a fantastic point. so kind of the poor man's version of the nuclear test is a three lead EKG. See, where you simply can get it is little zap for you.

And you look at the r to r p different. That's where the big spike is. Whenever your heart beats too large, the bottom of your heart contracts electrically, forcing blood through the arteries.

And that's called an R wave. And we measure the time sequence from one to the next to the next. And that gives us a measure called time domain of heart rate variability.

We know that that number is low abnormally low in those with Parkinson's. But there's another side of heart rate variability besides that time measure of our difference.

It has to do with frequency. And there's fancy math called fast Fourier transform that can dissect the frequency from your heartbeat and tell you how much sympathetic and how much parasympathetic you have in you going on in your body.

And this is your autonomic nervous systems kind of tug and pull given give and take in the nervous system. And when people have high sympathetic tone that comes with pain and anxiety, and if they have high parasympathetic tone that a lot of fatigue, you know, very difficult, you know, even sometimes it's an adrenal level problem, but they definitely will feel it.

Noninvasive Therapies and Clinical Takeaways

Now with Parkinson's, we certainly have impairment in the parasympathetic regulation of the autonomic nervous system. It's clear, especially as it's more advanced.

But we can see it early. And what we see there is this high frequency tone which is quite correlated with parasympathetic activity, is is quite clear.

And they have an impairment in that part. So if you have impaired parasympathetic sympathetic regulation, you will by default have feelings of anxiety because the parasympathetic job is to kind of balance and and put things into perspective in your autonomic system and keep it well balanced.

And if you have dysfunction in the parasympathetic regulation you will have anxiety symptoms that affect sleep irritability and things like that clinically.

the kind of the good news is, if you can measure it, there's some easy ways to try to modulate it with therapy like heart rate variability, biofeedback, which would be an adjunct therapy that doesn't have side effects.

And so looking at the heart variability is a must with Parkinson's not only for diagnostics but also to guide treatment by its definition and by its mechanism, is a training to reregulate the parasympathetic tone.

So you have a very targeted therapy for the impairment that's common to Parkinson's. And it's so simple to do at home. So it's a must in my opinion, for every person with Parkinson's.

So just to summarize, because I know unfortunately I have a shorter interview today, we have a tool called EVOX. It is a test of brain physiology focusing on brainwaves.

And it's computerized in such a way that the computer can analyze the software, can analyze the data that's collected, and then presented in a very different way than just looking at the routine EEGs that most every neurologist performs, either in their office or in a hospital.

and it can this test can be helpful both diagnostically, but also tracking therapy, tracking outcomes. Or if we make a change, do we want to know, hey, what is the result of that change?

Are we moving in the right direction? So ultimately what I'm hearing too is that we're tapping into the brain's neuroplasticity because we're giving people opportunities to really get a hard measure of what's going on.

And then because this is the solution summit, I want folks to understand that the solution, once you have the data, is then to take action steps and remeasure, because tracking is critical here, remeasure.

And then we can see the results of the effort. That's right. And the nice part about re measuring is you're not exposing yourself to more radiation with other type of imaging tools.

So it's, it's noninvasive and interesting. And some of the therapies that are neuro modulatory are transcranial magnetic stimulation. So literally changing the neuron firing pattern with a coil magnetic coil TMS very effective tool.

And there's different reasons why that we don't have time to go into. But the mechanisms make perfect sense. It's why they dovetail so well with EEG measures.

Even transcranial direct current stimulation, which is a very tiny two milliamp intervention, very effective. Now,

some of the most recent research just this this year, even says DKS, is a reasonable therapy for the motor symptoms associated with Parkinson's.

And it's noninvasive again, super easy, very inexpensive, and safe. There's a, the paper talks about the safety and even neurofeedback is the last 2003.

And this year, as well as shown studies that fMRI neurofeedback and other neurofeedback can remodel that motor system in the brain. And this is secondary to the benefits for depression and pain as well.

So some adjunct therapies like TMS, DKS, neurofeedback, heart rate variability, biofeedback, plus the medications involved, if you combine all these, there's a lot that can be done, for Parkinson's.

And this is even before talking about deep deep brain stimulation and lesion ING, which is very invasive. We can do a lot of noninvasive things. First, really summarizes so well what we're trying to accomplish in the Parkinson's Summit is to let people know that we're certainly a bit you know, I prescribe the dope all the time.

I do have patients with DBS, but how often do we have conversations like we're having now and showing people that there are solutions out there that are FDA approved, that are science backed, that are peer reviewed?

All the things that we like to talk about, we say it actually works. And I was telling Dr. Hagedorn before we pressed the go button on the interview, that this test that I've used in my office, probably since about 2017 or so, it was just it was a game changer.

It is a game changer. We continue to use EVOX testing here in Ozark. So, I appreciate you, Dr. Sharlin, for all you're doing for your patients and for the academic community as well, because a lot of our peers are still kind of in the dark ages.

On the use of technology. Sadly, I know we have a hard stop in a minute. So I do want to thank you so much, Dr. David Hagedorn CEO and chief Scientific officer for Evoke Neuroscience.

If you would like to learn more about this technology, they have a wonderful website and they have a lot of folks that are involved in education that work with the company, and I'm sure they would be more than willing to set some time aside.

so that folks can learn more about what EVOX has to offer. And I know about 20% of people involved in watching this summit are practitioners. I would definitely encourage you to consider investing in this technology to help patients.

Thank you. Thank you so much. Thank you again for your time. Dr. Hagedorn.