

Announcer: Bulletproof Radio, a state of high performance.

Dave: You are listening to Bulletproof Radio with Dave Asprey. Today's cool fact of the day is about how the way we sleep is hijacked. It turns out humans are the only mammals that willingly delay their sleep. Shift workers are at an increased risk for almost every chronic illness, including heart disease, problems with your gut, and your body never really adjusts to shift work. Snoring is the primary cause of sleep disruption for about 90 million Americans, and 37 million have that problem on a regular basis.

It turns out that English bulldogs are the only dogs that have sleep apnea. That's because they're unusual airway anatomy, basically short snouts and underbites, causes the problem. It turns out the first CPAP machines for sleep apnea were made from vacuum cleaners, and those were for humans, not bulldogs. Insomnia isn't defined by the sleep you lose each night, but by drowsiness, difficulty concentrating, headaches, irritability, and the other things it causes in your life each day if you have it. Because I've been practicing the art of foreshadowing, you could probably guess that today's episode is gonna have something to do with sleep.

Today's guest is Dan Levendowski, who is returning to Bulletproof Radio after his first appearance in 2014. He is the President and Co-founder of Advanced Brain Monitoring. They're a neurodiagnostics device company that's been working on human sleep for about 20 years. When he first came on the show, they had a new sleep apnea device called Night Shift, and today we're going to talk not about that, but we're gonna talk about why so many people don't get good quality sleep, and what we can do about it.

The reason that this matters so much, as you probably read in Headstrong or the Bulletproof Diet, is that sleep quality is at least as important as sleep quantity, and probably more important. I'd rather get six hours of total rockstar sleep than eight hours of crappy sleep. We have this ridiculous thing we do as people, where we oftentimes will say, "You need eight glasses of water a day." But we don't say, "How hot is it? How heavy are you? And how big is the glass anyway?" We just pick random numbers, and we say that they're good, but we don't also say, "Well, what kind of water was it? Was it sparkling? Did that matter?" There's all these variables that, it turns out, can change the quality of everything, but they're just ignored in the interests of simplicity. When you talk with a real scientist who's going in and looking at this, and saying, "All right, what do we do about quality of sleep first?" That makes me super excited, and that's why Dan's back on the show. Dan, welcome to the show.

Dan: Thank you. Thank you for having me.

Dave: I'd like to understand what made you, I'm just gonna use the word obsessed with sleep, and not a lot of people spend 20 years of their life looking at that problem, getting quantified things. What motivates you to do that?

Dan: Well, actually I started out looking at sleep disorder breathing. You mentioned earlier that one of our products was a sleep apnea therapy. We've been doing EEG, measuring the brain's electrical activity for over 20 years. Most recently, starting in about 2010,

started looking at higher quality measurement of the EEG during sleep, because you really need to understand all of the micro architecture of what's going on with the brain during sleep, to get the variables that we're now being able to use to look at the effect of sleep. For example on neurodegeneration or being able to phenotype, phenotype is where you have a very distinctive characteristic. We're beginning to phenotype insomnia, for example, to identify what type of patients who have insomnia that may be better taking hypnotic medications, and which would be better for other types of therapy as a treatment.

Dave: You're doing this by gathering medical grade sleep data on people, and then doing a lot of analytics on it in a way that really wasn't possible even 10, 20 years ago. You had to be in a hospital to get that. Every time I've spent a night in the hospital I can tell you my sleep wasn't very good, because these nurses kept coming in and poking, prodding, bright lights, it's the worst sleep environment on Earth. I feel like all that data is junk data, to be perfectly honest. You're doing this though, now at home with clinically validated devices. We can see what people's sleep actually is like in a normal environment.

Dan: That's correct. When you discuss sleep, there's really two aspects. One is what they call architecture, and that's where many of your listeners may be aware of, they have lighter sleep, and deeper sleep, and rapid eye movement sleep. We have a total of four stages of sleep. Then there's sleep continuity, and that's the part where if your sleep is getting interrupted or fragmented, then you don't get as much continuous sleep. Those two pieces work together, to where if you get quite a bit of slow wave sleep, that's good. If, when you're on your back or during REM sleep, if it's fragmented you may wake up not quite as refreshed. These are all parts of looking at the entire aspect of sleep, and breaking it into different parts to say, "This part may be normal. This part may be abnormal," and that could explain symptoms."

Dave: Right now, you've had research with DARPA, the Advanced ... the Department of Defense Advanced Research Projects agency, and what? A few dozen patents, and \$32 million dollars in clinical research, this comes from large amounts of data. We understand that architecture, but when you boil all that down, it sounds like what you're saying is that people with kids, and people who sleep with a spouse are pretty much screwed.

Dan: Well, not necessarily, but we're mammals, we adapt. It's simply a question of what potential risk does it pose down the way. For example, the Alzheimer's and Dementia Conference is ongoing right now, last two days, and one of the studies that they presented was talking about sleep interruptions during the night, and increased risk of neurodegeneration. You may have kids, hopefully they grow up, and you don't continue to have them over multiple relationships, to where 20 years down the road you get a break. They're not interrupting you so much.

There are things that you can do that may affect you for three of four years, but being conscious of the interruptions, and the fragmentations, as well as the total amount, and how it's distributed. Slow wave sleep is very, very important. You're better off having an

hour of slow wave sleep every night, than having REM sleep for the aspect of managing neurodegeneration.

Dave: There have been times in my life, especially about eight, 10 years ago, when I used to use a device called the emWave. Sorry, not the emWave, the ZO, that you could sleep with. It was this really dorky looking headband. My wife didn't really like how I looked in it, but I would sleep with that. I had nights where I got five minutes of deep sleep. Now, if I use the right stuff before I go to bed, if I'm wearing the glasses, the TrueDark sleep glasses before bed, I can get one to two hours pretty reliably. It seems like I have to get multiple variables stacked up, but I'm not using clinical grade tech. I'm using my Oura ring or I'm using a wristband and all that. I'm really interested in testing the TrueDark glasses using the ABM technology, or actually it's not called ABM. What's the technology called that's doing that?

Dan: Well, it's a Sleep Profiler, is the product that we've developed for this purpose.

Dave: All right, I am going to get one of those after the show, and validate how the Bulletproof sleep mode supplement works, how the glasses work. Right now, my practice that seems to work, is dim all the lights in the house. If I'm up after dark, I have red lights in my office. I wear the TrueDark glasses. I take sleep mode before bed. I tend to sleep like a baby every night. I don't wake up, ever. I've also trained my kids, who are now eight and 11, to not wake me up in the middle of the night. They sleep in blacked out rooms. They tend to sleep all night long, and have never really had a problem after they were maybe two.

I wanna get more data on that, but for people listening it's pretty tough to get a good night's sleep, especially if your spouse kicks you a lot or has a snoring problem, things like that. I think my wife, Lana, if she does snore I sleep so deeply I don't really know, which is a really good thing. I also use software when I'm traveling that helps me sleep better as well, called Sonic Sleep. I guess I'm a weird example. I'd like to see what my sleep waves look like from a clinical data like in a hospital sleep mode. You're the only guy out there who's got that level of detail. I use good data, but not great data on a regular basis.

I'm really interested in correlating that, and that's something I think for everyone listening, you need to be doing something to know how well you slept. If you know you sleep like crap, or you know you have apnea, or you know you snore, or you wake up feeling like a zombie, the way I used to, then I would say getting clinical grade data is probably worth it. Do you agree?

Dan: I do. One thing you can do with the clinical grade data is you can put on your Oura ring or whatever else that you're using, that is, we'll call it simpler, less sophisticated, and you can wear those at the same time that you're wearing our medical grade device to get a baseline. If your Fitbit is off by 15% or 20%, and you know what the gold standard is, then you can look at the Fitbit on a day to day basis, and maybe only go to medical grade once a year just to get re-calibrated, if you would.

Dave: I've learned over 20 years of quantifying various things, is that you can usually get really high quality data, but it's a serious pain in the ass to do it. That means that data that's pretty good, but is effortless is more valuable on a regular basis than the hard to get stuff. Just like you're describing there I tend to say, "I'm going to work on this. I'm going to get all the data," and then I'm just going to go in to sort of background mode and just collect what's easy. I think either you're a super geek like me, but if you go to bed with 15 different devices on you just because you have to have the data, you probably have a problem that's maybe related to anxiety or similar to an eating disorder, like a fear of not getting enough sleep, that's a real thing.

It's not in the DSM to be diagnosed, but there are people who are terrified of being tired, and they can develop this, but if you're just curious and saying, "How do I improve it? And I'm going to stop gathering most of that data as soon as I've improved it, and I am where I want to be." I think that's what the people who are evolving the most do. Having a new tool like the one you just talked about is actually a real gift, because you couldn't do this before, and that's one of the reasons I wanted to have you on. The other reason is you've just had a new paper come out about, some of them we talked about in our 2014 interview, and there's a sleep position that leads to neurodegeneration. What is that sleep position and why does it suck so much?

Dan: I'm going to back off a little bit on what you stated, because I am a scientist. We'll start out, Chris and I went to a conference in Turin, Italy in February that was on Alzheimer's and Parkinson's. We have a large National Institute of Aging study that's underway right now, where we're looking at the Awake EEG, and the Sleep EEG to come up with predictors of neurodegeneration. From this research we found that the patients who had mild cognitive impairment or Alzheimer's, and now we've added patients with Parkinson's, dementia to the group, what they all had in common was they tended to sleep more on their back than, we'll say age-matched healthy controls.

The paper has currently been submitted. I'll be presenting the data in Germany this fall with their Sleep Conference. We're not saying it causes it, we say that there's an association, which means there could be an increased risk. It's very early in the discovery phase, but there is good scientific evidence that how the brain clears the neurotoxin proteins during sleep ... there was a rat study in 2015 that showed that the rats anesthetized on their back did a poor job of moving these toxic neuro proteins during sleep, and we've just been the first ones to discover this in humans.

Dave: It's fascinating because when you look at conditions like heart disease, autism, Alzheimer's, it's highly unlikely that there is a single cause. It's sort of like, "What's the cause of bread?" You get the scientist who says, "Well, I bake the yeast, and then I bake the water, and I bake the flour, and nothing happened. Therefore, there is no bread." It's a system, and I think it's safe to say, to your point, that, "No," poor quality sleep or sleeping on your back doesn't cause Alzheimer's, but it is certainly a risk factor for it, and it's probably contributing to the system of it. That's to say if you slept on your side all the time you could still get Alzheimer's, you just lower your chances of getting it.

Dan: That's very correct.

Dave: All right, what else do you think causes Alzheimer's?

Dan: Well, the most common factors are the same ones that are associated with sleep apnea, hypertension, diabetes, obesity, and as you get older ... One of the other things that happens as you get older, you get less slow wave sleep, almost by definition. It's during slow wave sleep that the beta amyloid is cleared from the brain. That's one of the reasons why when you're talking about some of the different products that you have that could increase slow wave sleep, I get excited wanting to be able to prove that it actually does increase slow wave sleep. Because that is a way to reduce the risk of beta amyloid accumulation, that they believe is associated with Alzheimer's disease.

Now, we don't know that by clearing it more efficiently you won't get it, but again, a lot of us, we exercise, we eat in certain ways to try, and help reduce risk and increasing the amount of slow wave sleep and sleep spindle activity, are the two characteristics in sleep that have been associated with Alzheimer's and Parkinson's disease. Meaning more is better.

Dave: There was a time when I was ... in fact, I did this coinciding with the birth of my second child, I said, "You know, I'm really not going to get more than five hours of sleep every night anyway." Any new parent discovers that pretty quickly. I said, "I'm just going to restrict my sleep to five hours. I'm going to eat about 4,500 calories a day and see if I can make myself fat, but I'm going to get less fat than the amount of calories I'm eating, and I'm going to show that different calories do different things." I went to this time where sometimes I get two hours of sleep at night, and I just said, "I'm just going to do it." I started Bulletproof while working full-time at another company. I put the time to good use, and I definitely burned the candle at both ends, and in the middle. On the nights when I got two hours of sleep I would run a 1.5 hertz alternating electrical current between my ears, which coincides with the deep wave sleep. I would wake up feeling like a great, golden god. Good plan? Bad plan?

Dan: I won't call [inaudible 00:17:18] because I haven't demonstrated objectively that it's right or wrong. What the evidence suggests is if you're sleeping less than six hours a night, there are just numerous ramifications, long-term, on increased mortality and the quality of life. Again, I turned 60 a year ago and I'm starting to think about how I want to live, and the energy that I want to have in my late 60's and 70's, and whatnot, and so some of the decisions that I'm making now is what's going to protect me 20 years from now. That's part of what I'm trying to incorporate in understanding the sleep, and again, if I could increase the amount of spindle activity or slow wave sleep, and I knew it worked, I'd be doing it religiously.

Just like I know a number of people who I say, "If you stay off your back it will treat your sleep apnea with our product," but they don't wear it, but I tell them, "But if you stay off your back maybe it's going to reduce the risk of neurodegeneration." It's funny how people will not ... sleep apnea is not important, but neurodegeneration is, and they have a different perspective that way, even though it's part of the same circle that you're talking about.

Dave: About 10 years ago I used to make it a habit to sleep on my back, and it's because there's meditation stuff I do when I was going to sleep that worked better when I would do it. I'd get perfectly aligned, and it actually felt pretty good, but I was also sleeping with a bite guard that held my lower jaw forward so it wouldn't fall back and cause me to snore. It was because of your interview in 2014 I said, "I'm just going to sleep on my side," like the evidence is in that side sleeping is just better. My goal is to live to at least a 180 years old, so I'm paying attention to long-term effects just like you.

I do get six hours and five minutes of sleep on average now, to be above that six hour limit. Actually that's just what I get, but I feel pretty remarkable when I do that, and maybe I should get seven. I don't know, but right now I don't know what I would do without that extra hours so I'm not doing it. Do you think there is merit to getting more sleep than someone needs to feel good?

Dan: Well, I think that, and again being a scientist wanting to say, "How much sleep are you actually getting?" Because if it's what you think it is there is what they call sleep state misperception, it is very difficult to actually know how much sleep you get, how quickly you fall asleep. We think we fall asleep. We might remember one or two times during the night waking up, and going back to sleep, but it's not uncommon to have five or six, what they call awakenings per hour, where your brain is awake for 30 seconds. You won't remember it at all, it's called sleep apnea, but those brief interruptions occur, and that's part of what your true sleep is that very few of us really know. That's what our device will quantify, "How many awakenings per hour do you have? How many cortical arousals per hour do you have? How does that compare to the normative database based on age and gender? Are you in the normal range?"

Dave: It's funny you mentioned that. When I was developing the Bulletproof Diet I wanted to stress test it. I went on a three month extreme keto, this is before keto became popular the way it is now. In fact, it might have been part of how it became part of the blogosphere. I did an Eskimo-like diet, I ate one serving of vegetables a day, the rest was pretty much pure fat and some protein. Towards the end of that I was not feeling very good, and my sleep monitor, at the time I was using a ZO, which isn't on the market anymore, I found that I was waking up a dozen times a night, and I had no idea I was doing it. I knew I didn't feel good when I woke up, but it was completely invisible, and that is an example of what you're talking about, where I just wouldn't have known. I would say, "I slept the whole night I don't know why I feel like a zombie."

It was one of the reasons that I recommend a cyclical ketosis diet, because if you are in ketosis some of the time or you're using an external source like Brain Octane you have ketones, but if you're just on ending no carbs I think it wrecks sleep. It wrecks sleep in women before it does in men, and I'm hoping that the kind of tech that you've got can help people who are doing ketosis without end, see what it might be doing to their sleep and know, "Oh, my sleep quality is going down maybe I should have some starch already." Then go back into ketosis, so that their sleep is rescued. Have you seen any data on extreme, either carb restriction or fat restriction or anything else on what that does to sleep?

Dan: The only research that I've seen is work that people are doing on fragrances to try and improve. One of our customers was evaluating different fragrances to see what might improve sleep quality that way, but up until the development of our product you had to go to a sleep lab in order to be able to get these measurements. It just wasn't readily available to do these sorts of ... You're talking about little mini-Petri dishes where if you have the device you could wear it and get your baseline, and then the next night you could try something different, and the next night try something different, and begin to compare across those and try and decide, "Well, this did make a difference." You factor that in and then make your next round of what else you want to try.

Dave: You've been doing this for 20 years, things have shifted in our culture around sleep over the last 20 years. What have you seen on the frontlines on that amount of time? What's different now than we had 20 years ago?

Dan: 20 years ago nobody even knew about sleep apnea. Now the amount of people that are getting diagnosed and treated is so much greater than it was 20 years ago. I think for starters it took a whole generation of people to tune in to sleep apnea and be aware of it, but now with all the wearable devices there's just been this new emphasis on sleep, and it is really great. The only thing that those simpler devices have is, I mean they claim that they can do some staging of light and deep sleep. We do have a university that's using our devices.

I mentioned earlier that it's going to be comparing them to see how accurate they all are, but for example the Fitbit, when it was first evaluated it looked at sleep efficiency, which is the amount of sleep time that you get for the total time that you're in bed. It matched the gold standard polysomnography was within 10% in only 40% of the people. What that essentially means is if you want to be within 10% of being accurate you're a flip of the coin likely of whether or not you're going to get that with some of the technologies that are on the market. I think that the phone apps will probably be worse than some of the ActiGraph phase one, which are the ones that you wear and they just look for movement.

Dave: It seems likely that the ones that are using a microphone on your cellphone are going to be lower quality data than something that's strapped to you. I was CTO of one of the wristband companies, the first company that could get heart rate variability from the wrist. The same technology that's used in the Apple watch today, and even then from heart rate you can determine respiration, so you know basically how someone's breathing, and how someone's breathing, and how their heartbeats are well correlated with sleep, but there's just one problem, when using a microphone you might not get great data. If you're using something on the wrist you might have moving artifacts, we move when we're asleep, and you have skin tone differences, you have moles. You might say, "Oh, seriously," or maybe it's positioned to over a vein and it wasn't before, but this could make a big difference for an individual. You don't know how big of a difference it is.

I believe that if you're using any of these technologies, and you use it consistently, the actual score is probably meaningless, but the change in the score over time is useful. If you get a score and says, "I'm getting an hour of deep sleep," you might really be getting

a half hour or an hour and a half, but if you know that when it says you're getting an hour, if the next night you got an hour and 10 minutes you probably did better than the night before.

Looking at that delta, that change, is something that everyone can do, and if you're doing it with the lowest common denominator, which I think is probably a microphone on your phone, because you set it next to your bed. Put it in airplane mode for God's sake, wake up. If you do that, "Okay, better than nothing," but if you were to correlate that with a clinical grade scan then you would know, and I'm not sure how many of us need to know, but if you feel like a zombie all the time, and you know you don't sleep well, and your spouse kicks you all the time because you're snoring, well, you know you have a problem and you should dig deeper than just what you're going to get from any of these other technologies. That's my algorithmic, that's how I think about it. Can you poke holes in that or ... I mean, you know more than I do by a long shot, tell me where I'm wrong and where that's right so people listening can know what's the lowest thing I should do? What's the best thing I should do?

Dan: I totally agree with you that calibrating whatever you choose as a monitoring device, and knowing how it measures up against the gold standard is where you start. I totally agree that looking at relative changes, once you've taken whatever device you choose to use, and once you've calibrated it to the gold standard then you can look at changes, relative changes for that. The only thing you want to do is factor in, I would say every couple of years because we're going to age and things are going to change. or if you put on weight things are going to change.

Now for your audience just to be aware, we're not talking about a sleep apnea test. This is ... Somebody jokingly named it the ZO on steroids because it is worn on the forehead, it looks similar to the ZO, except it's cleared by the FDA. It has published accuracy in being able to measure these sleep characteristics.

Dave: Long time readers of the Bulletproof blog or listeners of the show will know that when ZO first came out, this was the first company that could get EEG data from the brain. Instead of looking at heartbeat or breathing they would literally say, "Here is the electricity coming off your head," which is a gold standard for what's going on in your sleep. It was this ugly headband that you would wear that was definitely not designed by Victoria Secret, but it gave you shockingly good data, and ZO went out of business a while ago, as often happens with some of these technologies. They're ahead of their time, which makes them expensive, and a little bit harder to use, but it really changed my life to know how I slept so I could get better sleep. What you have now, Dan, is definitely a headband, and it's got an even bigger bump in the middle of your forehead. I definitely wouldn't qualify it as lingerie, but people wear it for three days so it's okay.

Dan: That's exactly right. The alternative is going into a sleep lab. Let's say from that perspective it's quite a bit sexier.

Dave: Do you ever think about doing some red satin coverings or anything?

Dan: No, but we have considered pink. The original version actually started out as a silver color, and we changed it in the next generation to black, because people said the silver looked like it was heavier and bigger. We changed it to black just to make it ... give it a more stealth look.

Dave: If you could make it look like Geordi's glasses in Star Trek Next Generation I would wear it every night, because that's just ... in my house that qualifies as lingerie. I'm just saying.

Dan: I got nothing for you there. In order to make it work there has to be some compromise along the way, and this is just one of them.

Dave: A fair point. Is there something that people should do, speaking of lingerie, if they're sleeping in a bed with someone else regularly to improve their sleep quality?

Dan: Well, temperature is a big one. The colder the room the better. I think going beyond that I would arguably say that women going through menopause is very disruptive to their sleep, and it maybe just like men with sleep apnea, I mean we have our different ... the men in their sleep apnea will develop at a younger age. What most of your listeners may not be aware of, is that most women will not, their sleep apnea will not evolve to where they actually stop breathing until after menopause. They'll snore, but they'll snore much, much less than men, but as they age they catch up to where both in the amount of snoring in sleep apnea, but after menopause. There is that early 50's age for women in particular, that they have the night sweats and everything else where the colder the room, the better.

Dave: Do we know what percentage of women over or past menopause get sleep apnea?

Dan: They've always said that half the number of women as men have it, and the numbers have changed. Back when the first study came out we said that 2% of women and 4% of men has sleep apnea, those numbers are now ... they've reported as much as 50% if they're over age 50 and going in for surgery, admitted to the hospital for general anesthesia. Nobody really knows the actual numbers, it's just the research that we've done in looking at the relationship between snoring and severity we found that after menopause it comes on, and becomes much more distinctively ... changes in the breathing pattern, where they could be loud snores. But there's also a lot in the literature where they talk about women who are pregnant, where they developed sleep apnea in the third trimester, and that creates a number of risks for the child with increased risk for Caesarean and low birth weight, and all of those are where they didn't have sleep apnea, but because of the weight gain in the third trimester they have it on a temporary basis.

Dave: What the heck would a pregnant woman do if she knew she has sleep apnea to solve the problem, to have a healthier pregnancy? I mean, my first book was about that, but not about sleep apnea, but about healthier pregnancies. I didn't know of this fact, how do we hack that for pregnant women?

Dan: Well, start out by staying off their back, and it depends on the severity. It's worth finding out. So many women simply aren't aware and it's ... Preeclampsia for example, they'll get diagnosed with a temporary hypertension, they'll be bedridden, but all of these things have been associated or go back to this temporary sleep apnea. Looking at the quality of sleep, looking at snoring is a good way just to check it out. If the snoring increases as they go through the trimester then they're at increased risk. There's a number of tests that could be done that are home-based just to see if they are severe, if they're severe they probably need to be on CPAP for the rest of that trimester or 'til term.

Dave: Doesn't CPAP totally wreck your sleep quality anyway because you're sleeping with a Darth Vader mask on?

Dan: For some people it's the best thing that could happen to them. It will save their lives. It depends on the severity, most of the focus of my research has been on technologies that could be as effective as CPAP, but not having to wear the Darth Vader mask. For example, I wear an oral appliance, I've worn one for 10 years to manage my sleep apnea. For a while I had shoulder pain, and I was sleeping on my back, then I would put on our NightShift to remind me to stay off my back. The combination of staying off your back with an oral appliance makes them on average twice as effective as either one by themselves. There are ways that you can combine technologies for some people, and not have to be on CPAP.

Dave: Now a lot of listeners may not know that a major cause of apnea is when your lower jaw sinks back and changes the shape of your airways. One of the early, first hundred interviews that I had on the show was with a guy named Dwight Jennings, who does jaw alignment and neurological dentistry. I actually have a square jaw, thanks to aligning my jaw, and I think my sleep quality is much better as a result. But he made a custom appliance for me that had a wire that went to my front teeth so my jaw could not fall back when I slept. I wore that for a long time until I kept cracking it, and now I use ... I sleep with a night guard every single night, but it doesn't keep my jaw from falling back because I never sleep on my back. I assume that's good enough. Is it good enough or should I still have something that holds my jaw forward?

Dan: Well, I would say that if you were a sleep profiler I would look at the patterns and I could give you the answer, because I could look at whether or not you're snoring is increasing with each snore, and then stops or and then if your heart rate is going up. These are patterns of sleep apnea, there's no reason to protrude the jaw forward unless you have sleep apnea. Because there are side effects from wearing a custom oral appliance, you can have tooth movement and other factors. There's no reason to do something as a precaution, other than maybe not sleeping on your back. Sleeping on your back is the death wish, you just don't want to do that.

Dave: Got it. In my case, I actually did want tooth movement, that was part of my appliance, and now I don't need tooth movement because we made enough space in my mouth for my jaw to come forward without impinging my trigeminal nerve. That's something that a shocking number of listeners have a problem with, and if your bite during the day, when you chew is creating jaw tension without you knowing, and I didn't know it was

happening because it always felt normal, that reflects in your vagus nerve, which causes sympathetic or fight or flight response, every time you chew, which is completely ridiculous. If you grind your teeth at night it causes that as well, you're pretty much always ready to hit someone at a cellular level, and that's not good for anyone.

I would say moving your teeth is a different thing, but what we're talking about here is the ability to just hold your jaw forward if you need it for sleep. You make something or ABM makes something called Apnea Guard, and that's an oral appliance that holds things forward. Is that commercially available for people? Is that a doctor's thing and there's one at the drug store? How do I know what kind of a guard I should use if I don't want my jaw to fall back?

Dan: Realistically if you're trying to treat sleep apnea you should have a custom appliance made. There just isn't much else available. The Apnea Guard that you mentioned is a product that can be fitted by dentists. It is not something ... it's not a boil and bite, it's not designed for somebody to wear or to fit themselves in their homes, it's a medical product. Again, not over the counter. I would suggest if you're aware of products, if you're aware of mouth guards that reduce sympathetic drive during sleep then that's a separate avenue of medicine, because strong sympathetic drive was another characteristic that we saw on those patients with neurodegeneration. It's also ones that we see that have hypertension.

There are certain factors that if you could ... if you find that a mouth guard gives you more what we'll call high heart rate variability, which is good, that there is ... that you should wear it. I guess what I'm trying to say is a mouth guard isn't a mouth guard, if you're treating sleep apnea that's one avenue. If you're wearing it for modification as you were talking about, that's the second. If you can do it to reduce vagus nerve drive that's another one.

Dave: Right now a good number of listeners are having some lights go off saying, "Oh, I want to do this." I've never had a really clear answer for this, if someone wants a bite guard for apnea or for relaxing the jaw at night, can they go to any dentist or do they need to go to a specific kind of dentist to get this?

Dan: I would suggest going to a dentist who's experienced doing this. We did research, our National Institute of Health gave us ... One of the studies that we did back in 2009 was looking at how to improve outcomes with oral appliance therapy for sleep apnea. When we got done with all of these research, what we concluded was it doesn't matter what appliance you wear, it depends on how well the dentist is trained to get the outcome that you want.

In most major cities there is already a dentist who specializes in this, a lot of them are running commercials on TV. Many of them are targeting men. Those appliances work great, the only issue is for some people it's not enough. You mentioned the Apnea Guard, where people use it is because if you have the facial characteristics and the size of the neck, it decreases the likelihood that just pushing the jaw forward, and bringing the tongue forward will be enough. Some people have what they call facial morphology, that is good that you can be treated with an oral appliance, and some people they're

going to be stuck wearing CPAP. Now if CPAP doesn't work, they're still better off with an oral appliance and staying off their back than nothing at all.

Dave: I've historically recommended people might want to say what you can call a neurological dentist, someone who's looking at the impact of the teeth on the nervous system. Because some of them look at apnea, but you're saying now that there's enough change over the last 20 years that you can Google around and find a dentist who specializes in these sorts of things, which is really cool. I'll give a shoutout to Dwight Jennings in the Bay Area in Alameda, who did the work for me. He was a very early innovator in the space, even before, I think, we knew that there were effects on apnea he was looking at the neurology of this. He's a Northern California cranio-facial something, something. I'm sure he's ... or just listen to the episode with him and I'll put that on the Shownotes, whatever the number was, but it is in the first 100.

That's something that everyone can do, what about someone without apnea, do you recommend one of those squishy bite guards, just so people don't grind their teeth down as they get older? Does that matter for sleep?

Dan: We're talking about now for managing snoring or just trying to ... assuming that improves their sleep quality?

Dave: Do we have any data on whether a non or whether a bite guard that just helps you with grinding is going to change anything in your sleep?

Dan: Grinding is a totally different world. I mean the bruxism is ... There are some recent literature that suggest that people who brux that grinding are trying to create the patency and the airway because the airway is collapsing. In some cases there's an overlap between bruxism, which is more easily identifiable by your dentist and sleep apnea, so there maybe some overlap between those two. But most of the time, and this is again another, kind of a negative thing is that most of the bruxism devices actually move your jaw back not forward. It can actually, if you're getting treated for bruxism, and you have undiagnosed sleep apnea, wearing your bruxing device can actually make your sleep apnea worse.

Dave: This reminds me of the home improvement DIY industry, and biohacking has a lot of commonality with that. If you're looking to save money and get something done, replacing your own toilet seal is something that you can probably do in an afternoon. You'll probably get good results from it, but if you have a professional plumber come in and do it you'll probably get better results that don't leak a year later, because you didn't do something you didn't know how to do.

We're at this point with our own biology where we have the ability to say, "Oh, I'm going to try a bite guard, because it's going to cost me \$20 bucks or \$50 bucks or a \$100 bucks, and if I go get a sleep study it's going to cost me a couple thousand dollars, and it's going to be in a hospital where I wouldn't sleep anyway, or I'm going to spend huge amounts of money and see if it's insurable, and spend eight hours with my annoying

insurance company saying no to something that they should yes to." At the end of the day a lot of just can't afford some of the medical interventions.

I'm a huge fan of doing something to see if it works, but knowing full well you may need to escalate if it doesn't work. It doesn't mean that there's no meat on the bone, it just may mean that you didn't do a very good job because you're not an expert. Over time as we start paying attention to our own biology, to our own sleep quality, to all these different little things saying, "Oh, wait, maybe that matters, and maybe I have control of it." Then escalating just to the level where you get results, so you don't end up going broke paying doctors, which I almost did frankly. I spent, at this point a million dollars, but when I started the blog I spent \$300,000 in 15 years doing all kinds of lab tests and interventions, and everything possible to reverse all sorts of bad stuff going on in my biology.

Now I'm performing way beyond what I would think, but I've also been blessed to be able to go see some of the world's very best in almost every specialty in order to learn the details so I could share them on the show. I don't want people listening to feel that they're going to solve all their problems with a \$50 appliance, but I also want people to feel that, "Wow, maybe that's a place to start, and see if it changes my life." If it does maybe you should double down on that instead of just doing something else. Do you like that mindset around, "Well, try it and see," is self-experimenting okay here?

Dan: I'll throw a couple of ... I think I like the concept that you have, the two things I'd like to just add to it is that home sleep apnea tests are now only \$200, \$300. You don't have to go to the lab. You can do it in your home. They're far less expensive now than they were five years ago. If you're a snorer the likelihood of you having sleep apnea, I'll put it 50%, 60%, it's just age. You snore when you're young, and as you get older the snoring, the airway, the muscles are not able to keep the airway open, it's highly likely that you're going to develop some level of sleep disorder breathing. Find out, get a baseline, find out where you're at.

If you have it, there are, and you're talking about over-the-counter appliances. There are some over-the-counter appliances that are more expensive, they're a \$100, \$120, and they adjust. If you're going to choose an inexpensive mouth guard choose one of the more expensive ones of the inexpensive over-the-counter. There's one, Snore RX for example, it adjust 10 millimeters, and that can allow you ... as opposed to some of the \$20 or \$30 ones, those are just going to be so uncomfortable that you're going to throw it away. It will be one idea that you're going to kick down the road and forget about it because you had a bad experience.

Dave: Got it. It's the wild west of biohacking these days, and I think that's really cool because people who even just do a few things, are going to see some benefits in their quality of life, and all of a sudden you have more energy. Then you can use that energy to either have more improvements or just to do stuff you care about, but I'm really looking forward to the day that's coming pretty soon, where we have so much data that the guess work that a lot of us are doing goes away. To that point, one of the things I think you have 10,000 data points, the sessions from healthy and impaired populations where you look at their brains and say, "What's going on? Is this person likely has Alzheimer's?"

Instead of trying to find a blood biomarker or something, which hasn't proven to be that effective, you can say, "Well, do you have the electrical signal that no one would be able to detect if you look at one brain?" But if you look at 10,000 brains over 10 years all of a sudden you say, "Oh, now we got the data."

Do you think we're going to get there, to the point where you just slap some electrodes on your head, sleep for a night, and say, "Oh wow, you're totally screwed. You go to do a lot," versus, "You're totally good," I mean, [inaudible 00:47:19] that, how far away from that are we? Is a better question.

Dan: Well, we are moving as quickly. Our company is, where the work that we're doing I mentioned that National Institute of Aging study, one of the biggest drawbacks is big pharma are trying to develop treatments for the dementias, is that Parkinson's versus Alzheimer's, versus Lewy Body versus mild cognitive impairment, it's difficult to distinguish which of those problems, cognitive problems, which bucket do you fall in until you're well along the way. The concept is, is early identification, and it would be a little bit like having a colonoscopy or a mammogram where you would go in, and once a year you'd get your brain tested to see where are you. If there's a family history of Alzheimer's for example, it's quite likely that you're genetically predisposed. The question is, is it progressing at a faster rate or is it stable?

We don't want to scare people, but being able to characterize them properly so somebody thinks they may have Alzheimer's, and it's actually Parkinson's, then the pathway and the potential drugs that might be coming, that are in phase three clinical trials right now, in one case there maybe something promising on the horizon, and the other one, "No, not yet." But if you're already at stage 12 before they finally figure out what it is, it's too late. The idea is finding out early and then doing the sorts of things like exercise and diet to try, and kick that can down the road.

Dave: Tell me every single thing you do to make your sleep really good.

Dan: I don't focus on my sleep. I do stupid things like I drink probably too much wine every night before I go to bed, which isn't necessarily good for quality sleep, but I choose to.

Dave: Alcohol does thrash your sleep, even a glass of wine you will not sleep as deeply on that, that's true.

Dan: That's correct. Now I can say that I've monitored it, and I've looked at it, and I could say that, "Okay, I really can't drink a bottle of wine and get a good night's sleep," but a glass or two a few hours before bed doesn't seem to affect me that much. As I mentioned earlier, I'm 60 now, the amount of slow wave sleep that I'm getting that meets what they call the clinical criteria of slow wave sleep is less, but I'm looking at my spindle activity. I'm looking at how many sleep spindles am I getting because that's another way of protecting the brain.

Dave: I've actually noticed a very big difference in my sleep quality based on the quality and purity of the wine that I drink, bulletproof.com/wine, I think leads to the company that

makes the cleanest wine that I've seen, if that URL still works, Dry Farm Wines. I definitely noticed if I drink wine that tastes good, but afterwards I get kind of groggy, drowsy from a glass of it, it's just wine that had either glyphosate or mycotoxins in it. Then I don't sleep as well from that, and there are other wines where I can have a glass of it and I feel pretty normal. There could be even variability between the type of wine you drink and your sleep quality, and what you eat for dinner can affect your sleep quality. You could always worry about being more perfect, but in your case you drink wine, which is a negative thing, but what are the positive things? You mentioned temperature, do you sleep in a refrigerator? How cold is your room?

Dan: Well, we're in wonderful San Diego, the house we're in has no air conditioning, but I got the wind blowing in off of the ocean, so I keep it cold and as cold as I can in the summer. Last night the fan was going because we don't have AC. My only point was that colder is better for getting good quality sleep. I think the choice of a bed and a pillow, and the type of mattress. I was on a mattress for several years and thrashed both of my shoulders, until I finally spent the money and got the type of mattress that allowed me to stay, to be able to sleep very, very comfortably on the left and right side. The height of the pillow is also just as important. These start getting into ergonomic factors, but it does make a difference on how you physically feel in the morning. My shoulders are thrashed because I have osteo-arthritis in both shoulders, if I wake up and I'm in pain in the middle of the night, I'm not going to feel as good than if I wake up and feel good.

Dave: What's better soft or hard mattresses?

Dan: I think it depends. If somebody sleeps on their stomach, if they sleep prone, you generally need a firmer mattress, if you sleep your side you need a softer mattress. But the evolution of mattresses, the one that I recently got, I can't remember the brand, but it allows me to sleep on my side or my stomach. It provides full support. It was just expensive, but it was worth the investment, because if you think about it you're spending a third of every day or thereabouts, you maybe a quarter of your day, but a third of every one of my days is in this structure that is trying to make sure that I stay healthy for a very, very long time.

Dave: I read some research a while back that looked at what traditional cultures did for sleep. Sleep positions, sleep firmness, and pretty much if you're lucky you slept on some crumbled up leaves for most of human history. I started sleeping on a closed cell, one inch piece of foam, rock hard, just on the floor, and for the first week everything hurt. I thought this was dumb, like cavemen didn't have science, but after a week or two I actually started feeling really good. Quite often I will do that, and I have an exceptionally nice mattress too, so I will sleep on that some of the times, but I find I get really weirdly good sleep from sleeping on a rock hard surface, where the body seems to adjust to that after a little while. I find that I have the least back pain when I sleep on something super firm, but it's only because my body is trained for that.

I wouldn't recommend that for everyone, but from an ergonomic perspective you may have something [inaudible 00:53:52] airways. I'm 6'4", I'm around 212 lbs. or something now, if I lay on my side with a normal pillow my head tips very substantially because pillows suck. I ended up having to get two substantial pillows, I put them in the same

pillowcase that will hold my head up so it's still straight if I sleep on my side. Until I started putting two pillows under my head I would always have a sore neck, and I feel like I've become this obsessive sleeper where I want my head to be in alignment with my spine when I sleep, but this is not on my back, it's on my side. Is having your head tipped really far to one side going to contribute to apnea or poor quality of sleep or is that just a neck pain issue?

Dan: Well, it's not going to affect the apnea, but it is a neck pain issue that affects sleep quality. It's still going to be wrapped in that same circle we're talking about. I noticed the same thing when I go out on business trips. When I'm at a hotel one night and they have nice pillows in my head, it's nicely aligned, and I go to the next one and they're not, and my shoulders are affected, my sleep quality is affected, and it is related to the pillow. I get what you're saying, I sleep with two pillows, one that I pull out and use more when I'm on my stomach, and I tuck it in the other one, and that's what gets my head to the same position you're describing for sleeping on my side.

Dave: Beautiful. I've got one more question for you, and you answered it in your last interview, but you don't remember your answers, I don't think, unless you prepped ahead of time. If someone came to you tomorrow, Dan, and said, "I want to perform better at everything I do as a human being, what three pieces of advice would you offer them? It doesn't have to be from your research on sleep, unless you think it merits that level. The three most important things you've learned in your life for people who want to be leaders in their fields.

Dan: Meditate or be mindful, get a good night sleep, and show some compassion.

Dave: Beautiful. Now for reference, last time you said find out if you have apnea and stay curious. There you go, we got three entirely different answers over just a four year-

Dan: As I said, I'm getting older, I'm thinking about life differently than I did then.

Dave: Awesome, and that's a sign of an active brain when you continue to evolve what's important. Thank you for being on Bulletproof Radio. Where can people find out more about all the different things you're doing? You have six different sleep hacking technologies you've worked with, is there a place to go?

Dan: We do have our website, it's advancedbrainmonitoring.com. There is information there. We talk quite a bit about if people wanted to have that diagnostic quality study, one of our customers is a company called Virtuox and they're based in Florida, in South Florida, and they will provide a service where they'll have our device dropped off at your home, where you can do three nights wearing it under any conditions you want to get the sort of diagnostic quality study that we talked about. When we spoke back in 2014 we did not have the service option available, we do now.

Dave: This is a way for people to get a clinical grade, hospital grade sleep study at home over three nights, and maybe have your cup of coffee after two o'clock, the way I tell you not to, and just see how it wrecks your sleep.

Dan: Or drink bad wine.

Dave: Drink bad wine or what I'm going to use this test for when I get it, is I'm going to be looking at the Bulletproof sleep mode, and the TrueDark Twilight glasses, the patented set of filters. I already know from my Oura ring that I'm getting twice the deep sleep, but I want to see the clinical grade difference between doing it and not doing it. I may have to get two of them so I can get six nights sleep for all of my experiments, but it's a cool idea.

Dan: All right. Well, we can send it back and forth, and you can do first ... I also want to see how well your Oura ring is actually picking up deep sleep, that will be another interesting one.

Dave: It will be. Dan, thanks for being on Bulletproof Radio. Keep hacking sleep, it's one of those things that will improve the quality of the world, and thanks for all you do.

Dan: Thank you very much.

Dave: If you liked today's episode, you know what to do, go to bulletproof.com/itunes, and that will take you right to Apple's website where you can take maybe five seconds to leave a five star review that says, "These kinds of shows that give you actionable advice on how you can have more energy, and do more things you care about, that's worth your time," and if you would say, "Thanks by doing that," I'll say thanks in advance for doing it.