



## Binge Eating Disorder: Can Deep Brain Stimulation be a Potential Solution?

Many of us experience moments when we can't control our food cravings—eating when we're not hungry and struggling to stop even when full. For some, this can escalate to binge eating disorder, significantly impacting quality of life and becoming difficult to manage. While behavioral therapies, medication, and bariatric surgery can help, they may not work for everyone. We're speaking with Dr. Casey Halpern from the University of Pennsylvania's Department of Neurosurgery to explore how Deep Brain Stimulation—a procedure commonly used to treat Parkinson's and other neurological disorders—offers a potential solution for managing uncontrollable food cravings when conventional treatments fail.

### Full Transcript:

**Shweta Mishra:** Hello, everyone and welcome to CureTalks. I am Shweta Mishra and I am thrilled to be hosting today's discussion on an important, but overlooked topic Binge Eating Disorder and the potential role of Deep Brain Stimulation, as a treatment option. Many of us eat not out of hunger, but due to stress, emotions or cravings, but for some, this becomes a chronic condition Binge Eating Disorder, which impacts health and overall quality of life. Now despite the available treatments such as behavioural therapy, medications and surgery, not everyone responds effectively. And that's where today's conversation gets really important and interesting, could a technology like Deep Brain Stimulation already used for conditions like Parkinson's also help manage uncontrollable cravings? To explore this, we have our distinguished guest here, Dr. Casey Halpern, Associate Professor of Neurosurgery and Division Head Stereotactic and Functional Neurosurgery at University of Pennsylvania who is also leading studies on DBS for impulsivity driven disorders like Binge Eating. Also, joining us on the panel is David Stanley, who is an author, writer and a teacher passionate about everything science. Welcome to CureTalks Dr. Halpern and David, it's an honour to have you both on the panel today.

**David Stanley:** Thank you very much, Shweta.

**Dr. Casey Halpern:** It's a pleasure. Thanks for having us.

**Shweta Mishra:** Thank you. Dr. Halpern, let's start with some foundational understanding for our audience. Can you briefly explain what's happening in the brain during a Binge Eating episode and what makes it different from normal cravings?

**Dr. Casey Halpern:** Sure. Yeah, our understanding of that comes from studies that have been done by my team and others in rodents but also using human imaging studies of the brain and now finally able to confirm and examine hypotheses in the human brain, thanks to some of these early trials that are happening in patients that have Binge Eating Disorder. What I can say is that there is a part of the brain that evolutionarily seems to be conserved in terms of its functionality, across species from mouse to human. And in fact, it's probably the only part of the human brain that has strong homology, that is conserved from mouse to human, because the human brain is so more developed with big cortices compared to the mouse \_\_\_\_\_. But the nucleus accumbens is a little structure, a primitive structure, sort of deep in the brain that's involved in gaining behaviour, it's a reward structure involved in processing reward seems to be very active during moments right before binge and perhaps that activity, from Mouse to human seems to put these species at risk of overeating. Over time, this structure of the brain seems to learn or exhibit activity that elevates during exposure to foods that we don't eat because of hunger, we're eating them because of the pleasure when reinforcing properties of these foods and when this activity ramps up a mouse, a primate and a human seemed to them, want to or have the drive to pursue that food. This signal is an electrical signal. The brain is



electrical circuit but it probably reflects some aspect of neural chemical release that is happening at that time that our electrical recording devices are picking up. So, it probably doesn't involve dopamine release, which is very enriched in this part of the brain. This part of the brain being evenly convinced.

**Shweta Mishra:** That's fascinating to learn. And it feels like it's not just will power, it's actual brain mechanisms that is driving our behaviour here. Now that brings me to another interesting question. How did researchers even come up with this idea that DBS typically used for conditions like Parkinson's and other neurological disorders would help with Binge Eating?

**Dr. Casey Halpern:** Yeah. It's a great question. I think a lot of this started in the sort of early 2000s when we started seeing the Deep Brain Stimulation could be highly effective for people with Parkinson's disease. People with Parkinson's disease also exhibit psychiatric comorbidities- depression, impulse control disorders, even binge eating. And there have been sort of publications with evidence suggesting that Deep Brain Stimulation either when delivered to parts of the brain involved in Parkinson's like motor circuits like to control tremor, seems to actually take the edge off of these impulses. And perhaps around that time, I was sort of a budding young scientist and really had the interest not only to treat people with Parkinson's, but to expand the horizon of deep brain stimulation. And knowing some of the evidence that dopamine is released into the nucleus accumbens during these dangerous moments or during these moments of put us in danger, I should say, I had the theory that, well, if we could actually deliver Deep Brain Stimulation during those moments, perhaps we could block and even restore inhibitory control to allow people to actually make choices, the concept of the food industry, hijacking our brain and that's related to unfortunately substances of abuse like opiates and cocaine really taking away our autonomy and leading to these automatic almost habitual behaviours. The goal here is to try to restore inhibitory control, deliver electrical stimulation during these moments when dopamine is getting released into the nucleus accumbens which is very analogous to how we treat Parkinson's with deep brain stimulation.

**Shweta Mishra:** Well, it's incredible to think that a technology used for movement disorders, could also help regulate food cravings. But for those unfamiliar with DBS Dr. Halpern, can you break it down for us? How does it work? And how is it applied specifically for binge eating disorders?

**Dr. Casey Halpern:** Sure. I often forget that, as neurosurgeon this is what I do every day but it's certainly not what most people do every day. So, Deep Brain Stimulation is a bit like a pacemaker instead of being implanted for the heart, it's implanted for the brain. And, often these wires are placed into motor circuits so into small little areas of the brain, that are involved in things like tremor, or severe movement disorders that are associated with Parkinson's disease. These wires are a millimetre in diameter, they're very small, they can be placed through the skull. We make the small opening in the skull a little window, about the size of a dime, very small. And we lock the wire in place under the skin using something that seals the skull as well. And then those wires are connected under the skin to a pacemaker like device that's placed all under the skin, usually under the collarbone in the chest. And for Parkinson's disease the device will deliver therapy or electrical stimulation continuously, that's important because people that have Parkinson's feel rigid and stiff and they have tremor 24/7. So, they need a continuous therapy. For binge eating disorder and related disorders in the mental health space, what we've conceived of starting in a mouse but then working our way to human, is a device that can anticipate these vulnerable moments, perhaps when dopamine is getting released into the nucleus accumbens beyond normal physiological levels. And when the signal ramps up this electrical signal that I mentioned earlier, I consider it like a biomarker, it triggers stimulation delivery. So, rather in Parkinson's that are getting stimulated continuously, for bingeing disorder and related conditions, that were studying, we envisioned that the device would be more of a smart stimulator. So, it would only stimulate during moments of need.

**Shweta Mishra:** Wow. So, now that we understand how DBS works in theory, what have you found in studies and what kind of results have we seen so far in using DBS in Binge Eating Disorders? And I know that you are leading a groundbreaking feasibility study, which is using neuro based RNS system to help those struggling with uncontrolled eating. So, can you talk a little bit more about this trial and who qualifies for this? And are the outcomes that you are expecting?



**Dr. Casey Halpern:** Sure. So, this sort of smart stimulator one that stimulates on demand and as needed luckily, we did not need to create it from the ground up. When we were studying this in mice, when we did standard Deep Brain Stimulation, it seemed to be very effective in suppressing binge eating, but the effects were temporary. And so we had this theory that we need to stimulate only on demand as needed other to avoid tolerance effects, for example to the therapy. We actually identified a device; it's called the Responsive neurostimulation system by NeuroPace. This device actually at the time was FDA approved for epilepsy. So, it's much like a deep brain stimulation device. In fact, the little wires are nearly identical. It is designed to detect seizures in the brain so people that have epilepsy who have considerable seizures. But otherwise actually patients with epilepsy behave normally.

And so, what NeuroPace conceived of was similar to what we were trying to build for binge disorder was a therapy that would stimulate only as needed. And so, in our case, however, rather than trying to anticipate seizures from happening, we were trying to anticipate binges. And what we did was, we actually programmed the device to detect moments when patients were particularly vulnerable, which is really when they were feeling urges, or food cravings, beyond normal hunger and we would program the device to stimulate during those moments.

Our early studies in humans have demonstrated that these patients can feel fabulous return of inhibitory control, their loss of control eating sprees, which is a standard measure that we use associated with binge eating disorder, seems to significantly improve. And while this is a mental health focused condition of behaviour clinical trial, it also seemed that restoring this inhibitory control was associated with some weight loss as well.

**Shweta Mishra:** Alright, thank you, Dr. Halpern. I know it's time for David's questions now. He's been patiently waiting and he has some very, very interesting questions for you and he will take you to the most unexpected thought-provoking questions. Please go-ahead David.

**David Stanley:** I always like that. She's like it's quite the build up here and puts me on the spot which actually I kind of enjoy. So, talking about the Binge Eating for a second, I just put this up in the chat, is it occurred to me. It's not one of the ones we had sent to you earlier, **do animals across species exhibit similarities in their bingeing preferences.** Like we know that in humans, certain kinds of foods predominate, right? And so, if you were doing this on other primates, would we see that gorillas or rhesus monkeys. Also like to binge on potato chips and ice cream? Is that within some degree of familiarity, with the different species? Is that common?

**Dr. Casey Halpern:** Yes. It is common and actually food reward is a very common method that scientists have used for decades to drive a variety of behaviours in primates. So for example, to actually train a monkey or a rhesus monkey on a computer test for trying to learn about their brain, perhaps the proxy to the human brain. In order to train that monkey on a computer test, to get them to want to actually partake in that task, you actually give them food rewards. So, they're very food driven species. Going back all the way to the mouse, there are actually different strains of mice that are more prone to binge eating and obesity. We used C57 black six mouse species, which is probably one of the more common male strains that's used in research, but there are some mouse strains that are actually fairly binge resistant, which we avoided and there's probably this one that's not very well inscribed. But as you move into the large animal domain, animals like pigs, which may not be surprising but also primates, monkeys, chimpanzees, all exhibit, sort of binge prone behaviours. I don't know about gorillas.

**David Stanley:** Okay, because you folks in Philly, you have some of the best potato chips in the world and I'm just thinking because that's like my personal kryptonite, as potato chips. And so I'm thinking I can just imagine that these other primates because we are so similar are also kind of indulging when they do binge in the same kinds of things.

Can I shift in gears a little, my wife, and some other people, we know, because of depressive issues, have done sessions or series of TCS Transcranial, right? I'm telling a Professor of Neurology about Transcranial



Simulation. Sorry. Is there a relationship between the kinds of effects that TCS does with folks? Because she had a really really nice, nice clinical outcome from that and what you're doing?

**Dr. Casey Halpern:** Yes. So, there is a relationship, obviously both of these are brain stimulation strategies. I believe you're probably referring to TMS Transcranial.

**David Stanley:** Yes, yes, you are. Correct. Sorry I misspoke.

**Dr. Casey Halpern:** Yeah. And that's no, that's okay. I mentioned it because there's also Transcranial Electrical Stimulation. TMS is actually FDA for depression. And so, it's a very good therapy for people with depression. The similarities that both use brain stimulation strategies one is obviously non-invasive Transcranial Magnetic Stimulation. I like it that you going to see your dentist, you go into a an office, you meet the doctor, you sit the dentist chair. But rather than getting a cavity drilled out, there's an external stimulation device. It can be mapped to the brain a little bit like Deep Brain Stimulation is meaning you can navigate for precision to make sure you are targeting the sweet spot, in this case for depression. And then the stimulation field can be delivered magnetically.

It can be effective for people with depression. It's also FDA approved for OCD which relates to what we're doing, a full Deep Brain Simulation and a bit more. The critical difference other than being non-invasive is that TMS is very good at modulating the surface of the brain. But for binge eating disorder, while there might be value in TMS for certain cases, perhaps milder cases because we're going really after the most severe of cases, the signal in the brain that seems to be so critical, that points people at risk for binge eating is very deep in the brain in the nucleus accumbens. Now, perhaps the nucleus accumbens has connections to surfaces of the brain that would respond well to TMS, but for now, it really seems to be important to be able to target deep in the brain and that would require at the moment, something more invasive.

**David Stanley:** Okay. I want to back up a little bit. This is kind of some basic information I think. Now, when we think of bingeing, we also tend to think at least in the public eye of people who are engaging and purging behaviours as well. And of course, when we think of purging behaviour that automatically brings anorexia to mind. How did those three things relate with the research that you found about what kicks off these bingeing episodes?

**Dr. Casey Halpern:** Yeah so I'll give a disclosure and as a reminder that I'm a neurosurgeon I'm not a psychiatrist or eating disorder psychologist that sees these patients for clinical purposes. And so my perspective is a little different if you were to ask a psychiatrist that question and we have psychiatrist on my team that would answer the question differently but I don't think they would disagree with how I answer this question. Anorexia is a major interest of ours, for a lot of reasons. So, it's a devastating condition obviously, it's the most needful of all psychiatric conditions after major depression. I think of binge eating disorder, which is a disorder related to compulsion. Compulsion being pursuing something that you want. Maybe something, that's rewarding. I actually want to hesitate from the word want because I actually believe that people are losing their autonomy. So, it's more than you're pursuing something that is relatively rewarding despite the risk or despite that punishment associated with it. Anorexia which is restriction in general, or bulimia there's a binge eating component but there's also a purging component, that's also compulsive and so I believe all of these disorders would benefit from at least a similar approach where you're trying to quell or call that drive to compulse, that urge to compulse, which would also relate to how we take care of somebody with OCD. By the way, we actually have experience using a very similar strategy like we're using for bingeing disorder, but for patients with OCD. Bulimia or anorexia are sort of the next phase but we haven't gotten there quite yet.

**David Stanley:** Now when we think about the humans and the way we feel satiated, we all have this thing in our head that says, oh well, you've eaten enough and I know some of it comes from pressure in the abdomen enough variety of places, but essentially, it's coming from the brain in one way or another. Now when people are on a binge, are they not getting the signal that says, you're full? Or are they getting the signal that says you're full but in a separate, more deeper, more underlying portion of your brain is saying,



oh no you're not full, keep eating. How does that work?

**Dr. Casey Halpern:** It's a really interesting question. Something I think about a lot. In general people that binge or not eating because of a hunger signal. Sometimes they start eating because of hunger but then it transitions into a binge that's particularly true for highly palatable, highly refined foods that we now eat. When I first started this work a long time ago, people used to say to me there's no such thing as food addiction, you can't be addicted to something you have to eat and my response to that was, you know the foods that we eat are really not natural foods anymore. They're all highly refined technologies that are built by the food industry to drive addictive behaviour. It's all part of the capitalistic world. So, the foods we eat drive the behaviour certain foods more than others of course. The more refined, the more highly palatable, the more the patient could be at risk for a binge. But in general, binges are separate and often can be dissociative, meaning patients could even have an impaired memory around that behaviour because it's almost like an out-of-body experience. So psychologically or subjectively patients are eating and they just cannot control themselves. It goes way into the appetite, the satiety signals. I think that it's reasonable to say that while they probably have a satiety signal, their ability to perceive it, or work, or sort of eat through it is quite pronounced, that's part of their disorder. Unfortunately, I also think a lot of the foods that people binge on are so highly refined that the satiety signal is probably delayed. And I think these foods are sort of created to have that function in a way unfortunately. Think if in general people are not bingeing on high fibre, (not audible) lean proteins. And if they were, they probably would feel the satiety \_\_\_\_\_. It's a competition of the food they're eating a bit of a dysfunction in the brain, and this out of body experience that they're having that allows them to eat beyond satiety.

**David Stanley:** Right. That's hilarious in a sad way that you said it just that way, because question number three in my show notes, this is word for word doctor. Nobody ever went crazy on kale and carrots.

**Dr. Casey Halpern:** Exactly. Yeah.

**David Stanley:** The most common foods consumed, and I'm throwing this out there for people watching, when bingeing on high fat meat items, jump into a slim gym sweets, we all like, we all do like, ice cream but most of us can say no to a pie, salty snacks, so it's something about satiety, our taste buds, it's these foods. What is it about those particular foods, do you think that make them so prone to bingeing, is it all about dopamine, food, sex, social media, all of that?

**Dr. Casey Halpern:** We tend myself included, we tend to oversimplify things when it comes to neurochemicals in the brain that modulate this, but dopamine is a critical part of it. We've seen even in mice, for example, if you give them a very high fat diet, they will develop binge eating within three or four days and actually in their nucleus accumbens physiology is changed. In fact, the physiology of the nucleus accumbens now makes it so bingeing is higher risk, and I think the food industry knows this to a certain extent. What's concerning to me is that exposure to fast food, highly refined foods is actually hijacking our brains and putting us at risk for eating those foods beyond homeostatic needs in the future. I've always envisioned that, a carton of french fries and I look french fries as much as anybody, but it really needs a warning label on it saying that this is known to put you at risk for binge eating beyond what you've from a healthy standpoint. Now that I don't know if that'll ever happen but I think it should there's warning labels on cigarette boxes, people still buy cigarettes by the way. But at least they're being informed and I think that's necessary for these highly refined foods who knows when that or if that could ever happen. So, I don't know if I answered your question. Well, but I wanted to make that point but these foods definitely change the brain and put us at risk in the future. People used to tell me like sandwiches where you're combining starch, white bread, highly refined meats that are very salty, the sandwich is not part of our evolution, which we eat now as routine bases. But those kinds of foods 200-300 years ago, nobody was eating, but we evolved to live in the society that we're currently living in where food is so readily available and highly processed.

**David Stanley:** Yeah. Now, this is going to be a little bit more speculation on your part. And I'm assuming since you have shown us that you're really interested in healthy eating as a lifestyle and you look fit like you're still an athlete, a runner or swimmer, or a cyclist, or whatever.





I was a professional cyclist for a while. And I knew an awful lot of us that had eating disorders. We would, if you ever watch the Tour de France, we were never that skinny because that's a whole new level of skinny, but I did know a fair number of the athletes that I was racing with both male and female that had pretty significant eating disorders and a lot of them that we later found out also had some significant depressive illness issues as well. In fact, I wrote an article for Valley news which is a worldwide cycling magazine a couple years ago about depression in the professional bicycle racing ranks and

I want you to speculate here about how all this kind of ties together, how depressive people sometimes will, especially when they're athletes' runners or swimmers or cyclists will damn near train themselves to death, because they have that.... It seems to me as alignment that those same kinds of things you describe as a binge disorder also hold true for some highly fit people with similar kinds of disorders. Can you run with that?

**Dr. Casey Halpern:** I can. I think the word binge is part of our evolutionary makeup as a health advantage, the ability to binge at one point in our evolution, was a advantage to survival. So, for example, In the hunter-gatherer times, if we found food we had a higher chance of survival. If we could eat all of it very quickly before another predator came to take it from us, but then also store it as fat for a long period of time that, that allowed us to survive because we didn't know when we were going to get our next meal. And that wasn't that long ago. Now we don't really have to have that problem of perhaps our obvious in some parts in the world where we do. But now we have a different problem where foods that are processed and designed by people with white coats, right? Not doctors, well, different kinds of doctors. My wife is a health coach, she always says to me the more we eat foods that were designed and created by people with white coats, the more we're going to actually see people with white coats because these foods are not natural but we still have the ability to binge. But we're bingeing on foods that are not healthy. And obviously, we've talked about this. That ability applies to other things like exercise and in some ways maybe it's a healthier binge, but the ability to "binge on exercise" could be a evolutionary advantage, could also be a healthy habit that we allow for. But I think there are times when unfortunately, that does go beyond what's considered healthy and this applies to athletes. People that are fast runners, often lose weight to be faster. People who are jockeys or rowers, boxers will lose weight to be in certain weight classes and yeah that can be done in a healthy way of course. But there are times when I think we go beyond that and you can see that as being kind of a binge but I think that humans have that ability because of our evolution because it wasn't time when bingeing allowed us to survive and it was an important part about our genetics. Now, it's probably less important but it becomes pathological in certain cases. Then if you take somebody who's at risk for depression and perhaps they use running to get some natural dopamine. Now they're at risk for doing that beyond healthy means or = healthy levels to restore their mood, but then they actually start bingeing on their exercise and it becomes unhealthy. And then food is such an easy lever to pull and if they want to be faster, now they're dieting And they're over exercising beyond healthy amounts and we're in this terrible disorder of eating disorders, purging from an exercise standpoint. it's a little bit of a vicious. It is a little bit of a domino effect, I should say and exercise is probably the body's greatest medicine, but with our binge sort of prone brains we have to be careful and I can relate with that at a personal level.

**David Stanley:** I can too and this is when I get done working out, when I get off the book because I still ride and I still train all the time, that's I'm gonna be doing that until the day I die. I feel like I've got that two glass of wine buzz. Yeah, that's the best buzz in the world, right? That right after the second glass of wine where you sit there, you can just finish stuff. And I have a long-time mindfulness practise I've been sitting on a cushion for 40 years and it feels exactly the same when you get off the bike or when you get out of the weight room, or whatever it is that you do. And if you ask any endurance athlete, they will tell you exactly the same thing that endocannabinoid buzz is really really addictive, isn't it?

**Dr. Casey Halpern:** It is, yeah, it's part of our evolution I think to make it addictive because when you're doing something for your health and it's making you healthier and you're going to survive longer because of it. And then, of course, there are some people, however, then take into the next level.

**David Stanley:** And, at that point, is that a possibility then where, for those folks? Because I know a couple of them and some of them came out of this, okay, several of them have literally taken their own life. Some of



the folks I wanted to interview for that article, one of the guys I actually tried to interview was in treatment at that time and was unavailable for the interview. It can be a horrendous kind of positive thing turned horribly horribly wrong. Is that an instance where something, like, what you're doing could you conceive that somewhere down the road you might be applying your technology to that sort of behaviour?

**Dr. Casey Halpern:** Yeah, we're trying to build a technology here for these compulsive problems pursuing something despite the risk and punishment of it. Because at the moment, it's invasive and we've thought about ways of trying to make it less invasive or non-invasive, and I think that's possible. It's just not currently feasible but maybe the near future. While it's invasive it'll probably be applied to the most severe of cases. So, people who have tried medication, behavioural therapy if they have severe obesity, they could even try bariatric surgery first. But if those available, more conservative options, fail, that's when you want to start thinking about something invasive. And while it's invasive then that can be scary for people. The risks of these procedures is I mean these are safer than a knee replacement, I actually like in the risk profile of these brain stimulation devices, be much more similar to a cardiac pacemaker than anything else, of course people have to get past the idea that it's the brain.

**David Stanley:** And I think they will.

**Dr. Casey Halpern:** There was a time when cardiac surgeons did pacemakers and patients went to the ICU for a week from monitoring, but now we do them outpatient and nobody seems to be nervous that this isn't moving target in the chest that we're putting these wires into because we're really good at these procedures now and the same thing is true for the brain. But we have to work to make it less invasive so that we can scale it to the many, many millions of people that need it. And I really, I empathise and feel for those that are struggling with eating disorders and disorders of purging. In my mind like these super athletes are super sort of highly controlled individuals. They're super ambitious but also very controlled, they can develop these problems. There's kind of like three categories in my mind. There's like the athlete and the person that is just very good at being very helpful and that's probably the goal. And then there's the individual who over does it a bit. They don't necessarily mean criteria for an eating disorder, but they have disordered eating and unfortunately, I think that is enormously common in our society. I can relate with it too. And I think that the amount of people in this country that count calories and restrict, because of it, I mean, we know that that's not the healthiest way to eat. People still do it. I think that's a problem and then there's the eating disorders, where people are really suffering. I think we need to help those, I think we need to help people with disorder eating get back to perusing these things in more healthy ways. But your answer, it's a little bit of a tight rope and the human condition has proven to not manage that tight rope very well.

**David Stanley:** I just have one more question, I know and that's actually that's a great segway. You have a clinical trial and so throwing the ball into your court here, talk for a few minutes about what about the clinical trial and what you have to do in order to qualify and who you contact? All that cool stuff?

**Dr. Casey Halpern:** Yeah, our clinical trials on [clinicaltrials.gov](https://clinicaltrials.gov) and there's contact information there. The PENN Neurosurgeon Clinical Research Division helps run this study, it helps me, with all of the recruiting \_\_\_\_\_, is the primary research coordinator, does a fabulous job. She's also an MD. This trial for now is targeting individuals who feel distress and suffer from loss of control eating which is common to all binges. They don't have to make criteria for binge eating disorder by the way. But the FDA has required us to limit this trial to people who struggle so much with loss of control eating that they have obesity and they have failed gastric bypass surgery or gastric sleeve surgery. So, they have to basically fail bariatric surgery, which unfortunately is common for people that have loss of control eating.

But if they've tried that as well as perhaps a medication and behavioural therapy, they would be criteria for this trial. The trial is a bit over a year long. We are recruiting really only three or four more patients, it doesn't sound like a lot. It sounds like it should be very easy to find these patients because they're so common. But now with GOP ones being available, a lot of people are interested in trying Ozempic as they should. Ozempic, Wegovy, Mounjaro, so we have sort of seen a bit of a pause in people enrolling for this trial, while all these medications have become available and they can be very effective for the right patient. But if



you've tried them or for whatever reason, don't want to, or can't try them, because of insurance, then our trial remains available.

**David Stanley:** I mean, I envisioned these people saying things, like, let's see a shot in my butt or wherever in my abdomen, or let this guy drill a hole in my skull, yeah, sign me up for that. Sign me up for that right away, right?

**Dr. Casey Halpern:** Yeah, right, the drilling always gets in the way, but it's important to know that if the medication fails you, there is something that is available to you and it's probably a lot safer than you might assume.

**David Stanley:** A buddy of mine who is a physician and he was just diagnosed not long ago with an astrocytoma. He's doing the chemo, the radiation, head surgery, and he said that he doesn't remember anything at all about the surgery, but one of the guys in the surgical team said, you were asking the most goddamn clinical questions ever. Whatever sedation you guys sort of use, he was asking all of these doctor type questions of the team about what was going on and he remembers absolutely not of it.

**Dr. Casey Halpern:** Well, it's probably better, he doesn't remember it.

**David Stanley:** That's what I think too.

**Dr. Casey Halpern:** We similarly do these procedures under conscious sedation. So, a little bit of IV sedation is kind of like a colonoscopy, we do enlighten it a little bit so we can actually communicate with the patient. Make sure they're safe and yes the patient's a little bit in La La Land. And sometimes they say things they don't remember. Sometimes they say things they do remember.

**David Stanley:** Yeah, that's interesting. So, at the end of all this, then what you're offering is the opportunity, when everything else has failed to use the Inherent Electrical Stimulation in the brain, and the chemical neurotransmitters in the brain to take charge back again of that on off switch that governs our satiety.

**Dr. Casey Halpern:** Exactly.

**David Stanley:** Kind of it in a nutshell.

**Dr. Casey Halpern:** That's exactly right. I think, one of the other sorts of opportunities that this work allows is to demonstrate that people with binge eating disorder and loss of control eating obesity, these are disorders of the brain like epilepsy, like Parkinson's. They're not neurodegenerative like Parkinson's and Alzheimer's. So, in some ways, they're a bit more like epilepsy, it's a problem that you'll live with forever. It's a quality-of-life problem, but we've learnt with those conditions that bring targeted treatments really help and that's also true for eating disorders, binge eating disorder, obesity, these are disorders of the brain and fortunately or unfortunately depending on your perspective, a treatment targeted to the brain is probably necessary, at least in the severest of cases.

**Shweta Mishra:** All right. Thank you. Thank you, Dr. Halpern, David, such a fascinating and insightful conversation we had. We learnt a lot about binge eating disorder and how it affects our brain, limitations of existing treatments and also the promise that DBS has as a potential solution. Although it's still in experimental stages, it's exciting to see how new science is pushing it, and what is possible to treat such complex disorders like Binge eating disorders. So, Dr. Halpern, a huge thank you for you, for sharing your expertise with us today. We truly appreciate your time and incredible work you have done and your team is doing. David heartfelt thanks of course to you for sharing your perspective and taking us through mind bending questions. We also thank the University of Pennsylvania for this opportunity and our audience, thank you for tuning in. If you found this discussion insightful, please do share with others who might benefit and don't forget to subscribe to [curetalks@penn](mailto:curetalks@penn) to keep learning. Thank you so much everyone. Until next





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