Deep Brain Stimulation

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Today, we're going to be doing a surgery on a woman who has a tremor that affects her hands. And it's actually a tremor that she's had for a number of years now that has been gradually getting worse and worse, and it affects her ability to do things – daily things – things that we take for granted, the ability to write, the ability to eat, the ability to drink from a cup. And she's a right-handed woman who noticed the tremor in her left hand for a number of years before she developed the tremor in her right hand. But both tremors are quite severe and affect her throughout the day whenever she's trying to do anything with her hands.

She has a problem that's called "essential tremor" – familiar essential tremor – because in almost all patients it's a genetic problem that actually is inherited as a dominant gene, meaning that one of her parents also had the same problem and her half of her children are likely to have the same problem. But it affects everybody in different ways. It starts at different ages and sometimes causes other things besides just tremor.

And today we're at Roosevelt Hospital, and I'll be doing a surgery to implant brain electrodes to try to suppress or decrease her tremor. Actually, we have to put two electrodes in because putting one electrode in on one side of the brain can only help the tremor in one hand. And often we will do that. Sometimes the surgery is just to put in one electrode. But in many patients, they have enough of a bothersome tremor in both hands that they prefer to have both hands tremor-decreased. So we have to put electrodes in both the left side of the brain and the right side of the brain.

And usually there's one side that we feel is the most important side to help with. In most cases, it's the hand that people write with – in her case, her right hand. She is right-handed even though her tremor is stronger in her left hand. So I will put the left electrode in first, meaning the left side of her brain, because that will help her right hand tremor first. But as long as that part of the procedure goes smoothly, we will proceed. And right away after that, I can put an electrode on the right side that will help her left hand. And then both wires, actually once they're in the brain, they stay under the scalp so that they later on can be connected to a battery which will be implanted like a pacemaker under the skin in the chest on the right side.

And to do this surgery, we have to prepare ahead of time by doing a procedure a week before the surgery, where I have already done four small operations on the scalp where I've put metal screws into the skull which stayed there from last week until now because after those screws are implanted, we were able to get an MRI of her brain and a CT scan of her brain, which allows us to plan the placement of these electrodes.

And then she woke up after the scans, and she went home that day. And now she's coming back today to do this procedure, which she has to actually help me with. She has to be awake during the surgery so that I can test the electrodes and make sure that they're doing exactly what I want before we finish the procedure. So the procedure involves giving her local anesthetic to numb the areas where the surgery is going to be done, but she has to be awake and be able to talk to us during the surgery.

In order to plan the electrode implantation, I'm actually able to use a laptop computer in my office to look at the MRI and actually the CAT scan that was obtained when the patient had the small procedure to put in the skull anchors. And the patient actually is already out of the hospital, maybe home by the time that I look at the computer in my office to do this plan; but I can show you what I'm looking at.

The MRI is obtained so that we can see in great detail the structure of the brain. And this patient's brain, like most people that have this problem, the brain is actually normal in appearance. And some structures that we can see,

we see on everyone's brain -- like this structure here, which appears somewhat whitish on the MRI, or this one here. And actually these structures were used to create an atlas of the brain from patients' brains that were used to create a detailed map.

On this image here, you can see some of the structures deep in the brain that actually appear on anyone's brain when an MRI is obtained this way. These structures like this whitish structure that crosses the middle here and this one here were used to develop an atlas, which is a way of determining the relationship of different parts of the brain to those structures. And that was done by using patients' brains – patients that allowed their brains to be used to create these maps or atlases. And we know where in the brain we want to go relative to these structures. So I can actually calculate the target that I'm aiming for, which you can see right here is in the thalamus. In this case, this is on the patient's left side; and it would be used to treat her right hand.

And if we switch to another view, now looking at this image here, once I have the target determined, we can actually follow the path of the electrode through the brain. I can actually make sure that the path is exactly what I want it to be – that it enters the brain at the top and stays inside the brain until it gets to the target. I want to be sure that this path does not cross through these black areas here or this black area here because those are areas where the electrode would actually penetrate through the surface of the brain in an area that would be more likely to cause bleeding. By keeping the electrode inside the brain from the very top down to the target, it minimizes the chance that we're going to cause any bleeding breaking any blood vessels. And this is one view of this.

And looking over on the right side is another view looking from the side, showing the same thing – that the path of the electrode through the brain enters at the top of the brain and stays inside the brain until it gets to the target right there.

And it's important to not only have the target defined very, very accurately – it actually has the accuracy of 1 mm, so that I know that when I place the electrode it's going to be within 1 mm of the target I chose on that MRI, but also the path through the brain has to be chosen carefully to minimize the chance that I'm going to cause a problem by passing the electrode down to that target.

We're going to get started – a lot of preparation really. I don't consider putting those little screws in to be really started, but now we will be starting. And I don't think you're going to feel anything, except maybe some poking. But if you feel anything that hurts, let me know.

And we're going to have a small, straight self-retainer.

And I'll take a second one also and a Pickup (inaudible).

Are you okay there still?

Yes, I am.

All right, now we need the platform back again and maybe just a couple of screws.

The first time, I marked the scalp; and now that we have the bone exposed, we need to mark the spot that we need on the bone. And then you're going to hear some noise from the drill.

Okay.

Remember I told you about the part where you're going to feel the vibration?

Yes.

And that's probably going to be the main thing. It's not going to hurt at all.

Actually, before we do that I need to do one more thing here.

Let me have suction. There will be a little noise now from the drill, and you could irrigate a little bit.

Do you have a straight curet? And then I need to have the B1.

So we moved the bone, but just inside the bone there's a layer of tissue that is almost like a thin layer of leather that is called the "dura" that covers the lines of the bone and it holds the fluid inside. And that's what we're looking at now. And sometimes it has some nerve endings in it that you might feel something when I touch there.

Okay.

But hopefully not much.

And we're getting fairly close to when we're going to have to do some testing and put the electrode in. But first I have to do a tiny bit more preparation for when I – once the electrode is in, I need to use something to hold it where I put it so it won't move. And I also at the same time can actually put a metal plate that covers up the hole in the bone that I just made so that you wouldn't have an indentation here that you would be aware of on the outside.

And then I need to see the plating system after that. But first, I'll use the B1.

A little bit more noise for a second. This is where the electrode actually will sit. The plate actually will come down to hold it into this drum.

What's the bipolar set on?

It's on 50.

Turn it down to 40 and irrigate while I do this.

And you may feel a little bit – for one second you may feel something.

All right, let's put this back in this pouch here.

Yeah, this is the drive actually we'll mount on the platform. All right, now we're ready.

And what cable are we going to use to connect for you – the white one? – oh, the other gray one. Okay, fine.

All right, now we need to attach the platform again – or actually no, we're going to open the dura first.

I just thought I should mention something. I think there's two more stiches in the back of my head.

Uh-oh, really?

Yeah.

I don't think so.

I do.

But thank you for telling me. You're feeling something in the back of your head that feels like stitches?

Yeah.

All right, well I will promise to look later.

Okay.

But I don't think there are any because I think I took them all out.

You're doing all right there, right?

Yes, I am.

Number 11, please.

The dura is open, and now we see the surface of the brain which has a very thin layer of tissue that's almost like cellophane which we have to actually cut through. And then once we're through that, the brain itself is very soft tissue that has microscopic blood vessels – nothing that would cause a significant issue with bleeding. So once we have this opening in the surface, we know it's safe to pass the insertion tube through it.

I just need that #11 back again.

And there's a vein here that we can see at the end of the exposure, but the vein is not touched during the procedure. And this cautery that I'm using is just to stop bleeding that comes from small vessels at the surface of the brain.

Okay.

All right, now I need to attach that to that platform. And those four screws –

Not as bad as I thought it would be.

Good.

I'm going to need that bipolar back again. Now I need the insertion tube.

All right, now we're going to have to have her hand up; and we're going to have to be able to tell if you have – the tremor gets better.

Now I just have to make sure I see when the insertion tube goes through the opening that I made at the top of the brain. This is now 15 mm above the target.

Which means what?

He's getting ready to put the electrode in.

All right, now we're going to watch because now the electrode is going to go down to the target.

Just the right hand?

Exactly, that's all we're going to be concentrating on right now.

And let me have irrigation again.

Can you put your arm out again – the right arm, straight out? Okay, like this --like you're stopping traffic.

Now watch her hand now. Sometimes when we put this into the target, you can see an effect. It usually takes 15 or 20 seconds to see a change. The brain has a delayed reaction to kind of the mild trauma of putting the electrode into that spot in the brain that disturbs it. And actually what we want to do with the electrical current – you see her shaking is better now – what we want to do with the electrical current is actually inactivate an area of the brain where the brain cells are hyperactive.

And the hyperactive neuron brain cells are what causes the tremor. So this actually is doing the same thing as what would happen if we injured that area of the brain, and we used to do that. Before we had the stimulators, we used to actually put an electrode into that spot and injure the brain on purpose to cause a permanent damage in that one spot.

Can you hold it out again for me like this? Touch my finger.

It almost looks like a little bit of ataxia there – not just tremor. The tremor seems to be better than it was.

How about hold up the left hand and the right hand together? You can see the difference now.

We're going to turn on what the zero electrode does the negative and the 3 as the positive – and with 60 pulse width.

I have it at 50/130 – or 90/130 actually.

Make it 185 for the rate.

Do you want 60 or 90?

Yeah, 60 for pulse width, 185 for the rate. The zero is negative and the 3 positive.

Okay.

And then what I'd like to do is actually turn it on at point 5.

Going up to point 5.

Tell us if you feel anything. You might feel at some point some tingling somewhere; and if you do, you should tell us, okay?

Just this hand -- straight out for me.

And now we can go up to 1.

It's okay – just hold it straight out.

Sorry, rest your head; don't try to lift your head up.

No, no, no – I want you to hold this arm straight out for me.

That looks pretty good.

Mary, touch my finger.

Let's try 1.5. Can you feel that your hand is steadier? Can you tell the difference?

Yes.

Mary, hold your arm straight out for me. That's pretty good. Touch my finger.

If she's as good as you, she's pretty good, Joan -- all right, a little bit of shaking there.

Can you hold this cup? Pretend like you're drinking.

Just with the right hand.

Just with the right hand.

Slowly, slowly – don't drink so fast.

That's pretty good. Do you want to write? I'm going to ask you to write again, okay?

No, this is at target with the deepest electrode active; and we may actually try the next electrode up in a second. But right now I always try the deepest one first.

I want you to do the spiral again right here, okay? Can you see it? I'll hold it for you.

Yeah, don't use your left hand at all – just your right hand.

Okay, can you do a spiral – like without touching the lines – like an Archimedes spiral? All right.

All right, you might want to show her an example of one.

Just rest your head – rest your head. Don't try and lift up your head.

What I want you to do is to try going off and on at 1.5.

Off and on, okay.

Yeah, don't ramp it up -- just go directly.

Tell us if you feel any tingling now.

No, I don't.

I turned it off so it went back to zero.

Okay, now just go to 1.5 as quickly as you can.

Okay, that's 1.5.

Did you feel anything?

No.

Don't move your head now.

Go up to 2.0.

Tell us if you do feel anything.

A very, very, very slight tingling.

Where did you feel it?

Down my arm.

Your arm – do you feel it in your fingers at all or just in your arm?

My fingers.

Which fingers? In your little finger and in your thumb?

Yes.

Do you feel it anywhere else besides your hand and your arm?

No.

Let's go a little bit higher – like 2.2.

It's going to get a little stronger probably. Do you feel it at all still -- the tingling? Is it still just in your--?

No, no, no -- I don't feel the tingling.

You don't feel it. It's gone away.

Go up to 2.5. That's good.

Anything there?

No.

No tingling still.

Go up to 3.0.

Any tingling now?

Yeah.

Where are you feeling it? In your mouth.

A little bit in my mouth and –

But still in your fingers – excellent. Can you count to ten for us loudly?

One, two, three, four, five, six, seven, eight—

Very good. Let's try checking the tremor again now. That looks very good.

Arm straight out – hand up like it's stopping traffic. Okay, touch my finger.

Yeah, what's causing trouble there is not really tremor. What's causing trouble there is a little bit of incoordination, which is a separate problem that you have because of the tremor.

That's pretty good, Mary.

Yeah, it's very good.

Now, one other thing I want to do is I want to turn it off. I want to see how she is with it off for a minute. And then I want to try it with the number 1.0 as a negative and 3 as the positive.

I'm going to borrow this cup back.

That's a soiled cup.

It is, but it's not used.

All right, let's try to check her. It's off, right? It's been off for a couple minutes?

Okay, arm straight out again for me.

This is with the – the stimulation is off now.

Touch my finger.

Yeah, the shaking is coming back. It usually takes a little while for the stimulation effect to wear off completely. But we're going to try checking a different contact. Where it is is giving us exactly the effect that I'm looking for. I just want to check the second electrode. What I did is I first checked the deepest electrode. And we're next checking the one above that.

So let's go to 1.0 and see what—

Tell us if you feel any tingling again.

Okay.

In your mouth -- do you feel tingling?

No, I had an itch.

That's okay. You're going to tell us if you feel it.

Hold this arm out again.

That's at 1.0 – that's pretty good – probably better than the deepest one.

Let's try 1.5.

Feel anything, Mary?

Hold up your hand. Does your hand feel any steadier?

Hold it up how?

Can you tell? No, out towards Joan.

Hold your arm straight out.

No.

The other one might have been better. Let's go up to 2.0.

Okay, hold it up again.

Any tingling yet?

No.

No tingling, usually the deepest one has the high – go up to 2.5.

Touch my finger again.

Probably the other one was a little bit better.

And let's try 3.0 and just see if she has any paresthesias at 3.0.

Do you feel any numbness or tingling?

Mary, are you with us?

I'm with you.

Okay, good.

No, no.

Sorry, I just wasn't sure there for a second. You don't feel any tingling?

Nope.

Usually the lowest threshold for the paresthesias is lowest at the deepest contact also.

Not too bad actually.

All right, I think we're good with this electrode. The responses are exactly what we're looking for.

I'm going to need a medium-size Weck clip also.

Now what we have to do is to get the electrode anchored.

Can I have a bayonet?

Bayonet?

Sorry, it's just what we call this instrument. We have some creative names. Nobody was really thinking about patients listening to us ask for those instruments when they made up those names – and we get so used to them.

I may need a snap again – not strong enough for that. All right, now I need a heavy scissor – bayonet again, a 4 mm screw. Hold that wire – hold it up maybe – a little higher even. I need to see where this wants to be. All right, we're going to attach it there. I need the bayonet again.

Now, don't move your head.

Now you can let go. I'll take the suction. What I want you to do is hold it just like that – maybe over like there. Got it?

Well, I've shown two companies this method already; but they haven't bothered to switch over to it yet.

The other thing is that on the post-op scan – we've got a CT scan after the surgery. And we can see where the electrodes are and make sure that the depth is exactly the depth that we want. And when I do the second – the last part of the surgery next week,when we put in the extension wire and the battery, we can actually adjust the depth here if we had to.

All right, now we need to get ready to see tremors in the left hand.

And, Joan, you're still with us?

Yep.

Good thing.

Can you hold your hand up like you're stopping traffic? Touch my finger – nope, other hand. Good – again. Okay, now try and hold this cup. Nope.

Nope, so just your left hand now this time.

Okay.

And then let's have her hold her hand up so that we can see it as we do the insertion.

Okay, just keep it up – straight out if you can.

Something that will enhance the tremor.

Like this – hold your hand up like you're stopping traffic again.

The other thing that might do it is if you just have her try to just–

Touch my finger.

Don't touch Joan's finger, but come close to it. Just try to hold just like you are there. A little higher up maybe? I'm sorry, can you do it? There you go.

Hold it up – hold it up!!

Oh, sorry – I'm sorry.

Sorry, we need you to stay with us and help us just for a couple more minutes.

Okay.

A lot of work today.

Yes.

Last week you got to sleep and this time you don't.

That's just from putting it in about 20 seconds ago.

Can you hold them both up for me? Straight out – straight out – hold it up -- okay. Now just this arm, hold it out for me.

What happened to that tremor? You have some, but it's not like it was a minute ago or a couple minutes ago. Now we're going to see if we can make it better.

Did you turn it on already? We're going to go zero -- start with the same one we did on the other side, zero negative, 3 positive – also 60 and 185.

Hold it up.

And just try to go to 0.5 and see if that does anything first and then we can go to 1.0.

0.5

Do you feel anything now?

No.

Don't move your head – just tell us if you feel any tingling at any point.

Try 1.5.

This is 1.0.

Oh, it just got to 1.0?

1.5.

Still don't feel anything, right – tingling or anything?

No.

All right, let's go to 2.0.

A little tingling.

You feel a little tingling?

Yes.

Where do you feel it?

Down the arm.

And your fingers also?

Yes.

That's exactly the same as the other side – the 2.0 threshold.

Mary, can you try to touch my finger?

I'd like it to be between 1.0 and 3.0, and I'd like that 3.0 not to be sustained. Up to 2.5.

Do you feel more tingling at all? Tell us if you do.

No, no I don't.

No tingling? Did it go away – the tingling?

Yes.

You don't feel it right now?

You're up to 2.5?

Try to test her tremor again.

Mary, touch my finger.

Don't move your head now. Leave your head resting.

Touch my finger. Over here – nope – left hand. That's more ataxia.

And you want to do the stop sign again?

Hold your arm straight out – the whole arm straight out – straighten out your arm.

That's pretty good. How about go to 3.—

Wait one second.

Sorry.

I just want you to write. Ready? Now, I'm going to hold – no, no, no. I want you to write with your left hand. It's already open. Now I want you to use your left hand, Mary.

Leave your right hand down because your right hand is going to interfere.

Can you see where--?

Yeah, I see. Do you want the spiral?

Yes.

Exactly.

Better than the right hand even.

Okay, can you do that one more time down here?

Okay, now with your left hand, can you hold this cup -- try to bring it to your mouth?

Slowly – are you okay?

That's pretty good.

Yeah, it is pretty good.

Okay, now I want you to touch your nose -- touch your nose, then touch my finger. Good.

Can you count to ten loud?

One, two, three, four, five, six, seven, eight, nine, ten.

Let's just see what 3.0 does. That was 2.5 – all that?

Mm-hmm.

Tingling.

Where do you feel it?

In my hand.

Anywhere else?

No.

Leave it on for a second.

Is that tingling still there?

No, it's spread down my arm.

Is it strong or not so strong?

Very mild.

Mild, okay.

Mary, can you touch your fingers like this?

Now her left hand is better than her right hand.

All right, I think we did enough testing. This looks the same as the other side.

And now, Dr. Kim, we could let her be sleepier.

That was great.

Yeah, terrific – both electrodes are doing exactly what we want.

Thank you.

Okay?

Fantastic.

So we're going to close things up and get rid of those little anchor screws that you don't like.

I just want to recap what you've seen here today. The surgery was done here at Roosevelt Hospital. And it was an implantation of deep brain stimulating electrodes into a part of the brain called the "thalamus" in order to suppress tremor in a patient who has disabling hand tremors from essential tremor.

And I'm Dr. Robert Goodman. With this surgery, we actually get to see the effect of the electrodes during the surgery itself. This patient has lived with tremors that have been present in her hands whenever she's tried to do anything now for a number of years. She hasn't been able to hold her hands steady to do anything. And now today, for the first time in years, during the surgery she was able to hold her hands steady; and she was able to see that happen when we placed that electrode into the brain but also when we delivered the electrical current.

And this is an incredible thing to me every time I see it because I know it's going to happen in every case that I do, but I'm still always amazed every time I put the electrode there and turn on the electricity that it does stop these tremors. And one of the most amazing things is that patients sometimes have a reaction when they see their hands stop shaking for the first time in years that they're just so gratified. And I'm just so happy that I can do that and that the patients will be able to do things with their hands that they haven't been able to do in years.

Right now it just simulates that just for a few minutes because the electrodes are not connected to a batter yet. And she will have her tremor until she comes back to have the last part of her surgery done next week when we will be able to implant the battery and connect it to the electrodes. And then afterwards, in the office, be able to turn on the stimulation and leave it on so that it can always provide the same tremor suppression that she saw today.

I know that you had the surgery actually about a month ago, right?

Yes, on the 9th.

And I saw you on August 25th. And on that day, we turned on the stimulator and got it to help you with the tremors in both hands, right?

Correct.

And before the surgery actually, your tremor bothered you more in your left hand than your right hand, even though you're right-handed.

Yes, it did.

So you use your right hand to write and to use a computer. And you usually use the right hand to drink things, right?

Yes.

And after the stimulator was turned on, on the 25th – actually, before that – even after the initial surgery, you noticed your tremor was much, much better. It was gone.

It was gone totally.

It was gone for like days?

Yes.

And you could do all sorts of things that you hadn't been able to do, like you were writing better

Totally perfect penmanship.

First time in a while?

Yes.

How many years?

Oh, about ten.

And then when we turned on the stimulator on the 25th, your tremor had already come back quite a bit before we turned it on.

Yes, it did.

And the stimulation brought down your tremor quite a bit again. It was really good, but it wasn't as good as it was the first day or two after the surgery, right?

Correct.

Which is probably because you know that when we do the surgery, it actually disturbs the brain a little bit and it takes time for the brain to recover. So it's good that it disturbs the brain because that's the part of your brain that's making you have your tremor.

Right.

But then we have to use electricity to disturb the brain later on after the brain recovers, and that's what we do when we turn the stimulator on. But it often isn't consistent because the brain is still changing for a month or two after the surgery.

So I know a week after I saw you, you went to see the nurse Joan that works with me; and she adjusted the stimulation and was able to make it work better then, right?

Yes.

And you've noticed that in the last few weeks, your tremor is better than it used to be before the surgery.

Right.

But still not quite as good as it was those first couple of days after the surgery, right?

Correct, the past couple of days it's been more prominent.

And you noticed it with doing what kind of things?

Carrying utensils, cooking, lifting my bottle to drink, and also using a mouse and writing

Right, but your tremor is still much better than it was before the surgery.

Dramatically.

You're able to do some things that you weren't doing before. Like what?

Putting an earring in without bugging my husband, which I haven't done in many years.

Now, you're nervous. I'm sorry.

Also, you said the eye makeup you're able to do now?

Yes, today is the first day I've worn eye makeup in like eight years. I've tried to apply mascara. Normally, I don't wear any because I'm afraid I'd poke my eye out.

Ouch.

And, yeah.

All right, so I wanted to see if we can maybe adjust the stimulator today to see if we can make it work even better today than it's been working. But the first thing I want you to do is to maybe pick up that bottle. And then try it with the other hand. Right now it seems like your right hand even has more tremor than your left hand, which is the opposite of what it was before you had the stimulator.

Correct.

Which means that the stimulator is helping a lot on the left and helping a fair amount on the right. And also, you said that you haven't had any side effects from the stimulation, right?

No.

So the stimulator is like a pacemaker right here, so we have to keep that there while we're doing this. And I'm just going to check and see the setting that it's at right now. And you tell me if you feel anything while I'm making these adjustments.

What I did is I turned it off – the one that controls the right hand. And so it usually takes a little time for the effect to wear off.

Okay.

And I just want to see if the tremor gets worse first before we turn it back on and then see if we can make it work better.

Do you feel like your hand is any different now?

It's a little more shaky.

It often actually takes hours or even a day or so for the effect to wear off when we turn off the stimulator. That's why sometimes with the old stimulators they used to get turned off sometimes when people would walk through a security detector or some other magnetic field. And they wouldn't know it was off sometimes until hours later when the tremor would get worse. They wouldn't know what it was that made it turn off. But now the newer devices are much more resistant to magnetic fields, so it's much less likely that you would have it get turned off accidentally.

All right, I'm going to try one other thing. I want you to hold your finger next to my finger, but don't touch my finger.

All right, and now try to hold both of your fingers up together, and then I'm going to turn it back on again. And if you feel something, you tell me. Anything?

No.

Pretty good – just making it a little bit stronger than it was before.

Just a funny feeling in my lips.

Yeah, like a tingling, right?

Yeah, and it's also making you have a little bit of spasm.

Talking funny.

Right, there are a couple of different ways we can make that better. What we do always with this is we're trying to maximize how much it reduces the tremor but without causing side effects like that.

Right.

So we're going to try to find a way to deliver the electricity – see, your hand is perfect now is perfect as far as the tremor goes. But you're still having some trouble talking?

A little – I feel like I'm drunk.

Yeah, and you sound a little bit drunk. So we're going to try – and we're always kind of going for perfect, but we often have to settle for a little less than perfect because I don't want you to have side effects.

I understand that.

Now, see your right hand is now much better than your left hand.

Yes.

You're talking a little bit better, you think?

One, two, three, four, five, six, seven, eight, nine, ten.

Pretty good, but you can tell it's a little bit different than it was before I turned it up?

Yes.

Did you have this trouble when Joan was programming you a few weeks ago?

The very, very first time in your office, I was talking funny or I felt a quiver in my lip.

All right, so right now count to ten again for me.

One, two—

Keep your hands up, sorry.

One, two, three, four, five, six, seven, eight, nine, ten.

Now, how about if you tell me the days of the week.

Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday.

That's actually pretty good. First thing I'm going to do is just turn it off for a minute and –

In certain positions, it goes wild.

But the left one is a stronger tremor to begin with, so the effect of the stimulation wore off faster on your left hand than it did on your right hand when I turned it off. And you might feel a little bit of something when I turn it back on. It's going to go on now. Do you feel any kind of tingling or anything when it went on?

Just a little something on the left side of the brain.

Right – on the left side of your body because I turned it on for your left hand right now. But you felt what on the left side?

Just like a little tingling.

Where?

In my head.

Yeah, what about your hand and your arm at all?

No.

Just in your face -- yeah, that's just the surge that when it first gets turned on like that, most people feel it for a couple of seconds and then it goes away. Now it's pretty good.

That's amazing.

All right, I think that's enough tweaking. We'll leave that one the same as it was, and I just changed the one for your right hand a little bit.

Thank you.

Anyway, thank you very much. This has been Dr. Goodman from Roosevelt Hospital in New York City.