AMERICAN PARKINSON DISEASE ASSOCIATION
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# Deep Brain Stimulation for Parkinson's Disease

The best treatment options for Parkinson's disease (PD) will vary from one individual to the next, and for every person, the best treatment will change over the course of the disease. The mainstay of treatment is medication, such as levodopa, that compensates for the loss of dopamine in the brain. But as the disease progresses, and more dopamine-producing neurons die, more levodopa is needed, often requiring higher and more frequent doses throughout the day to maintain effective control of symptoms. People with PD may develop increasing amounts of OFF time (periods during the day when levodopa and other medications are not offering benefit), and dyskinesia (uncontrolled movements usually during the time of peak benefit from a dose of levodopa). At this stage of the disease, deep brain stimulation (DBS) may provide an important treatment option to reduce OFF time, improve dyskinesia, and potentially improve quality of life. It can also be particularly effective at controlling tremors, which in some people are not controlled well with standard doses of medication.

## What is DBS?

Deep brain stimulation (DBS) is a neurosurgical procedure in which thin electrodes are implanted into selected deep parts of the brain that control movement. By stimulating specific points in the motor control circuits, DBS disrupts abnormal brain signals thereby restoring more normal movement. In many cases, this allows the person with PD to reduce their dosage of levodopa, and thus reduce their dyskinesias while maintaining good symptom control.

There are numerous contacts along the length of the inserted electrodes that can deliver electricity to a very targeted area in the brain. A battery-operated pulse generator, much like a cardiac pacemaker, is implanted under the skin of the chest or abdomen. The pulse generator is connected to the stimulator electrodes via wires, which are tunneled underneath the skin of the scalp and neck.

The equipment is not visible underneath clothes and causes no discomfort in daily use.

Many different stimulation variables can be programmed wirelessly for maximum symptom control. These include which contacts along the electrode should deliver the stimulation, and the size, frequency, and duration of the pulses of electricity delivered. Patients also have a limited ability to change parameters on their DBS systems wirelessly themselves. The batteries can be replaced by an outpatient procedure when necessary, typically after several years.

DBS systems are now typically MRI-conditional and can be placed in MRI-mode or turned off for the duration of an MRI, making the process of getting an MRI with a DBS system in place much simpler than with older systems.

There are several DBS systems that are available for PD, and they are all slightly different. Each offers its own technology in programming the stimulation variables, with the goal of maximizing symptom control and minimizing the side effects of stimulation. Certain systems offer rechargeable batteries which do not need to be replaced as frequently as non-rechargeable batteries. Talk with your neurosurgeon about the different options to decide which one is best for you.

## What Benefits May DBS Offer?

DBS is not a cure for PD, but it may help control motor symptoms and enable people with PD to take less PD medications. For many people with PD, this surgery can reduce tremor and rigidity, improve movements, help reduce dyskinesia, and reduce OFF time. DBS does not usually increase the peak benefit derived from an appropriate dose of levodopa—the best levodopa response is a good indicator of the best response to DBS—but it can help extend the amount of time a person has their best levodopa response, which may significantly increase quality of life.

Typically, DBS does not improve the non-motor symptoms of PD such as depression, sleep disturbance, or anxiety. DBS also does not typically improve balance. If a symptom you have does not respond to levodopa, it is not likely to respond to DBS. DBS may also worsen cognitive function in patients who already have cognitive impairment before surgery. Typically, neuropsychological testing is performed before DBS to ensure that no significant cognitive issues are present.

## What Are the Risks of DBS?

As with any surgery, there are some risks associated with DBS including a small chance of infection, stroke, bleeding, or complications related to anesthesia. Your neurosurgeon will discuss any additional risks with you.

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Studies have shown that the risks are relatively small, but they should be kept in mind when considering DBS. As with any surgical procedure, the best outcomes tend to occur at high-volume DBS centers that perform many of these procedures.

## Am I a Good Candidate for DBS?

DBS is typically offered to those with PD who retain a good response to levodopa, but who have developed significant motor fluctuations, in which there is OFF time between doses during which PD symptoms return, and ON time with dyskinesias, during which there are rapid, involuntary, and uncontrollable movements as a side effect of PD medications. DBS can also offer significant benefit to those with tremor not adequately controlled with medication.

Although DBS is typically done at more advanced stages of disease, the US Food and Drug Administration (FDA) has also approved DBS for earlier stage Parkinson's disease. Talk with your doctor about whether DBS is an appropriate treatment option for your clinical situation and when the right time for surgery might be.

Before considering DBS, it is very important to be evaluated by a movement disorder specialist (a neurologist who is trained in treating PD). Medication adjustments and other treatment changes may offer significant benefits and delay the need for surgery.

## What Happens During DBS?

The surgery is often performed when the patient is awake, using mild sedation and appropriate pain control, with the head immobilized in a rigid frame. This allows the surgeon to monitor the patient's symptoms as the electrode is placed to ensure accurate targeting of the electrode. Some DBS centers are equipped to perform the surgery in the bore of a CT scanner or MRI machine, allowing for visualization of the advancing electrode and optimization of placement. When performed this way, the patient can be completely asleep during the procedure.

A second surgery is performed on a separate occasion to implant the pulse generator into the chest.

## What Happens After the Procedure?

You will likely remain in the hospital for one or two nights following your first surgery (electrode placement). Following your second surgery (pulse generator implantation), you will probably go home the same day.

The stimulator is turned on several weeks later, after you recover from surgery. Adjustment of the stimulator may take repeated visits over several weeks or even longer. Adjusting the stimulation settings after surgery is a critical part of optimizing the treatment and is key to obtaining the most benefit. Your treatment team will recommend changes in your drug treatment at the same time to maximize your ON time while reducing dyskinesia.

National Headquarters
American Parkinson Disease Association
PO Box 61420
Staten Island, NY 10306

Telephone: 800-223-2732

Website: www.apdaparkinson.org

Email: apda@apdaparkinson.org



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Revised by Rebecca Gilbert, MD, PhD, *Chief Mission Officer*, APDA, 2024.