Deep Brain Stimulation for Parkinson’s Disease

Fact Sheet

WHAT IS DEEP BRAIN STIMULATION?
Deep brain stimulation (DBS) is a therapy that uses mild electrical pulses from an implanted device to stimulate the brain. A DBS system looks and operates much like a pacemaker—except that instead of sending pulses to the heart, it delivers electrical stimulation to a precisely targeted area in the brain.

To date, more than 40,000 people worldwide have undergone a DBS procedure for Parkinson's disease.¹ DBS has been proven to be effective in the management of Parkinson’s disease and essential tremor symptoms. It has also been shown to be beneficial in the treatment of the symptoms of dystonia and obsessive compulsive disorder, and the FDA has approved a humanitarian use exemption for these indications. DBS is also being investigated for use in treating depression and a wide range of other neurologic and psychiatric disorders.

WHAT IS THE HISTORY OF DBS?
Cases of electrical stimulation of the human brain were reported over a century ago.²³ The use of DBS to treat Parkinson’s disease emerged in the late 1980s when a researcher named Alim-Louis Benabid and his colleagues showed that chronic stimulation of an area of the thalamus could effectively alleviate tremor symptoms.²³ Within the next several years, researchers explored other viable stimulation targets for treating Parkinson’s disease and essential tremor symptoms.

The current stimulation targets include those that had previously been established as surgical targets through a procedure known as lesioning, a technique which involves the selective removal of targeted, abnormal brain tissue. However, because DBS is reversible and adjustable, this procedure has been shown to have distinct advantages over lesioning.

WHAT IS A DBS SYSTEM?
A DBS system includes the following components:

- **Neurostimulator**
  A surgically implanted, battery-operated device, which generates mild electrical pulses.

- **One or more leads and extensions**
  Thin wires that deliver the mild electrical pulses from the neurostimulator to the target area in the brain.

- **Programmer**
  A device that allows a clinician to fine-tune the way that electrical stimulation is delivered to the brain.

- **Patient controller**
  A remote control that allows patients to check the battery in their neurostimulator and to turn their neurostimulator on and off.
Leads are implanted in the brain and are connected to extensions, which are passed under the skin and are connected to the neurostimulator. The neurostimulator is typically implanted near the collarbone. Depending on the patient's needs, a surgeon may implant one or two neurostimulators.

**WHAT IS PARKINSON’S DISEASE?**

Parkinson’s disease is a chronic, progressive, neurodegenerative movement disorder affecting approximately 6.3 million people worldwide according to the European Parkinson’s Disease Association. Each year, an estimated 60,000 new cases in the U.S. are diagnosed, joining the 1.5 million Americans who currently have Parkinson’s disease.

The neurology community classifies Parkinson’s disease as a movement disorder because its primary symptoms affect the body’s muscles and movement. The disease is considered chronic, because its symptoms persist over time, and progressive, because those symptoms always worsen. Parkinson’s disease occurs when nerve cells, called neurons, in the area of the brain known as the substantia nigra die or become impaired. The neurons of the substantia nigra produce a chemical called dopamine. Dopamine has various functions in the nervous system, one of which is to help regulate body movement. After about 60 percent of these nigral neurons die, the level of dopamine is abnormally low and noticeable symptoms of Parkinson’s disease begin to develop. The four typical symptoms of Parkinson’s disease are resting tremor, rigidity (stiffness), bradykinesia (slowed movement), and postural instability. In addition to these motor symptoms, Parkinson’s disease can cause patients to experience symptoms unrelated to movement, such as loss of smell, anxiety, and depression.

Once symptoms of Parkinson’s disease begin to interfere with a patient's life, a physician will typically prescribe medications to reduce the severity of the symptoms. Though several types of medications are available, the medication Levodopa is currently considered by many to be the “gold standard” of treatment in the management of Parkinson’s disease. Levodopa replenishes low levels of dopamine in the brain of a Parkinson’s disease patient. Levodopa is extremely effective at alleviating many of the primary motor symptoms of Parkinson’s disease. However, over time, Levodopa often becomes less effective at controlling symptoms and begins to cause side effects, such as sudden uncontrolled movements called dyskinesias.

**WHY DBS FOR PARKINSON’S DISEASE?**

DBS can effectively reduce Parkinson’s disease symptoms such as tremor, rigidity, bradykinesia, and gait disturbances. Stimulation is typically applied to one of three target areas:

- Subthalamic nucleus (STN)
- Globus pallidus interna (GPI)
- Thalamus

Overall, DBS has been shown to reduce 50 to 60 percent of Parkinson’s disease symptoms. However, the specific amount that DBS suppresses symptoms varies based on the patient and the stimulated target. DBS allows many patients to regain more control of their body, allowing them to live more normal and functional lives, as well as reduce the amount of medications they are taking to treat the disease. Though DBS may greatly reduce the typical symptoms of Parkinson’s disease and the dyskinesias resulting from Levodopa therapy, patients still need to regularly see their physicians to sustain medical care and to manage remaining Parkinson's disease symptoms.
WHAT ARE THE ADVANTAGES OF DBS?

DBS offers distinct advantages over other surgical treatments. First, DBS is adjustable. One of the unique benefits of DBS is that the stimulation programming can be tailored to each patient's unique needs by a clinician. Second, DBS is reversible should the patient desire or need to have the system removed. Third, unlike lesioning, DBS does not destroy brain tissue, so it potentially preserves a patient's ability to benefit from future therapies that have yet to be developed.

A recent study published in the Journal of the American Medical Association concluded that DBS was a more effective treatment than the best medical therapy for the management of moderate to severe Parkinson's disease. According to the study, at a six-month follow-up, DBS was more effective at improving motor function, "on" time without dyskinesias, and the patient's quality of life.

WHAT ARE THE DISADVANTAGES OF DBS?

Implanting the DBS system carries the same potential risks of surgical complications as with similar neurosurgical procedures. Possible surgical complications include hemorrhage, stroke, headache, confusion, and infection.

DBS has not been shown to protect the remaining dopamine cells in a parkinsonian brain, nor has it been shown to slow the progression of Parkinson's disease. Additionally, DBS does not improve the non-motor symptoms of Parkinson's disease, such as depression and anxiety.

REFERENCES


*The Libra® and LibraXP ™ Deep Brain Stimulation systems are not approved for use in the U.S.*