



Medtronic

Medtronic DBS*

FOR PARKINSON'S DISEASE



Therapy Information

*DEEP BRAIN STIMULATION

CELEBRATE *Daily Victories.*

This Parkinson's disease information brochure has been developed with the guidance of a European physician advisory board. Members of the advisory board are listed below

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This brochure should be used by physicians to provide patients with information about Medtronic DBS

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What is Parkinson's Disease?

In Parkinson's disease (PD), certain cells within the brain gradually cease to function properly. These cells are responsible for the production of a chemical called dopamine, which allows communication between the brain cells that control movement and coordination of the body. The loss of dopamine means that the messages from the brain which tell the body how and when to move are delivered more slowly, so that patients are unable to initiate and control their movements in the normal way. Many of the symptoms of PD are related to this inability to control muscles and movement (called motor symptoms), but there are four main categories that are characteristic of PD:

- Tremor: involuntary, rhythmic shaking when the body is at rest
- Rigidity: stiffness or inflexibility of the limbs or joints
- Bradykinesia/akinesia: slowness/absence of movement
- Impaired balance (postural instability) and gait

Other motor symptoms may also be present (e.g. speech problems, difficulty swallowing, loss of facial expression, small, cramped handwriting, etc.), as well as problems that are not related to movement (called non-motor symptoms) – the latter may be just as troublesome to patients as the motor symptoms of PD:

- Pain
- Constipation
- Skin problems
- Urinary problems
- Muscle cramping
- Fatigue and aching
- Depression
- Dementia
- Confusion
- Memory difficulties and slowed thinking
- Loss of energy
- Fear or anxiety
- Sleep problems



Over time, the level of dopamine in the body gradually declines and new symptoms begin to appear. The type and severity of symptoms varies between patients, and one patient may have a different collection of symptoms to another. PD becomes progressively worse over a period of years and if not treated effectively can cause disabling symptoms that may have a great impact on a patient's quality of life.

How could PD have an impact on the quality of life?

It is important to remember that PD develops in different ways over time, depending on the patient. **If left untreated**, PD can progressively worsen and patients may find it increasingly difficult to perform their normal activities, such as dressing themselves, rising out of a chair, moving across a room, maintaining hygiene, feeding, etc., and they may eventually require the use of a wheelchair. Sleep disorders, memory disturbances and confusion can also cause problems. As a result, patients may experience difficulties in coping with their disability, and it is possible that their social activities will become limited, or that they have to reduce their work activities. Depression is also common in patients with PD. If PD is left untreated, all of these factors can seriously affect the quality of life of patients and those who care for them.

Yet patients should not despair. PD affects every patient in a different way and there are treatments available that can help to reduce some of the symptoms associated with PD, allowing them to maintain their quality of life and to enjoy the good things in life.

Therefore, it is essential that neurologists talk to their patients so that they can receive the most effective treatment to control their PD symptoms and help them to regain control of their life.

How can PD be treated?

It is important to recognize that there is currently no cure for PD. Nevertheless, there are several kinds of treatment that may effectively manage the symptoms of PD for many years, allowing patients to live a relatively normal life. With the help of a neurologist, patients can decide which therapy is the right one to suit their particular symptoms and needs.

If a patient's symptoms do not trouble them, they may decide with their neurologist that they do not need any treatment initially. Instead, they may focus on a healthy lifestyle, including exercise, relaxation and diet, which should be maintained throughout their life.

Oral medication

When a patient's symptoms begin to have an impact on their life, they can initially be controlled with small amounts of anti-Parkinson drugs (e.g. dopamine agonists, levodopa, etc.), which are taken by mouth (orally). These are designed to increase the level of dopamine that reaches the brain or stimulate the parts of the brain where the dopamine works. As PD is a very individual condition and people respond in different ways to medication, these drugs are prescribed and adapted to each patient's specific needs.

As the condition of the patient progresses, they may need higher doses or more than one type of drug to control their symptoms. However, this can be associated with an increase in side effects, including nausea, vomiting, dizziness, psychosis, dyskinesia, etc.

Eventually, drugs may no longer control a patient's symptoms effectively or may lead to troubling side effects. When this occurs, there are several other therapies that may be tried, as outlined on the following pages.

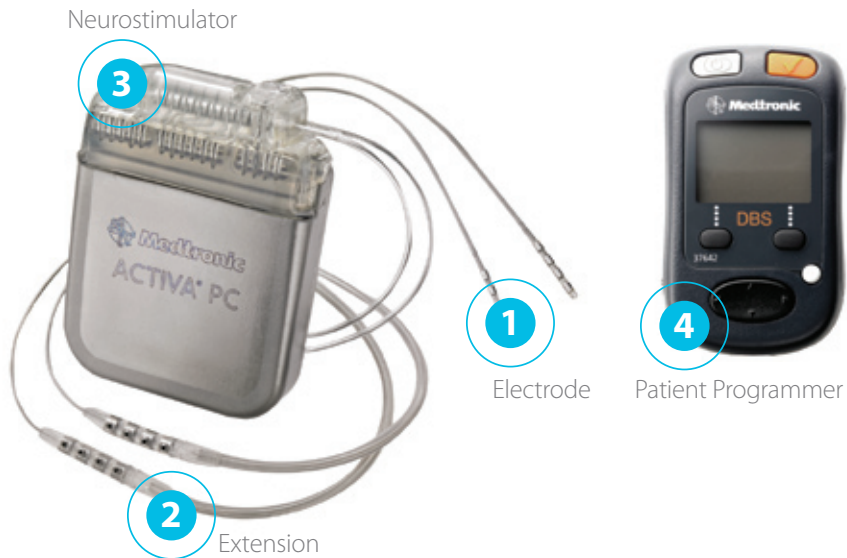


Eventually, drugs may no longer control a patient's symptoms effectively or may lead to troubling side effects

Deep brain stimulation therapy

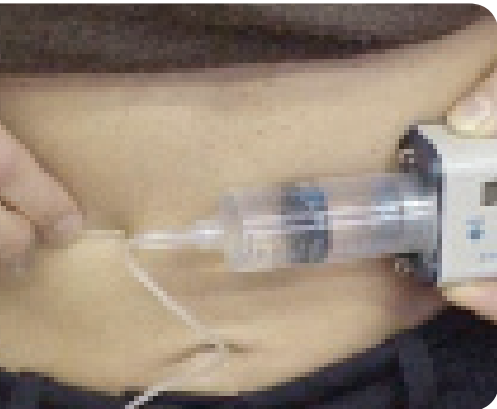
Medtronic Deep Brain Stimulation (DBS) therapy is a reversible therapy involving the surgical placement of a thin, insulated lead into the brain (most often in an area called the subthalamic nucleus), which is then connected via an extension to a small device called a neurostimulator (rather like a pacemaker) that is usually implanted under the skin in the chest or in the abdominal area. The system is fully implantable and patients will not be able to see the leads or the neurostimulator outside their body. When the neurostimulator is switched on, it produces electrical impulses that are sent to the brain to stop or reduce the electrical signals that cause the symptoms of PD. The impulses can be adjusted using a patient programmer. Patients will still need to take medication for PD, but they may find that they require much lower doses.

DBS therapy is most effective in patients under the age of 70–75 years. If a patient's PD symptoms can no longer be controlled with medication (e.g. tremor, which can be very responsive to DBS) or they are experiencing troubling side effects, they may be a candidate for this procedure even if this is early in the course of the disease.

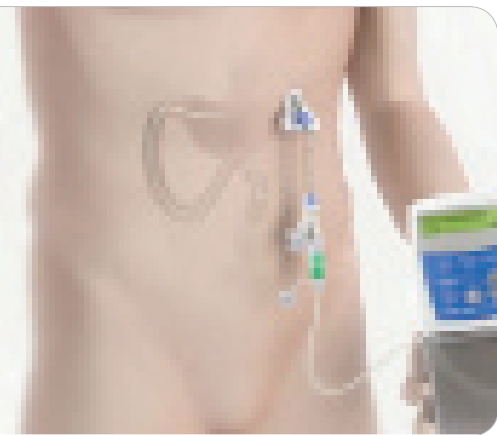


Other methods of drug delivery

Most anti-Parkinson drugs are taken orally, which means that they pass through the stomach and are quickly broken down, making the drug less effective. To avoid this, there are two drugs which can be given in ways that bypass the stomach altogether.



- **Apomorphine**, which cannot be taken orally as a tablet because it is broken down and becomes inactive in the liver, is administered into the fatty tissue under the skin where it can then reach the blood. The drug is either injected under the skin, or continuously administered using a pump. Apomorphine can be effective for certain patients and is commonly used when there is inadequate control of PD. It can be used on its own or alongside oral anti-Parkinson drugs.



- **Levodopa/carbidopa gel** is administered through an external pump connected to a catheter surgically implanted into the upper part of the intestine, from where the drug can be absorbed into the blood. This method allows continuous delivery of the drug throughout the day. This therapy is only used in patients with advanced PD. It has proven to be effective, but requires patients to have the external pump attached to them at all times, which may limit some activities of daily life.

Other surgical procedures

Lesioning is another type of surgery that may be performed for PD, in which electrodes are inserted into the brain during surgery (and then removed after surgery) to cause selective damage to the cells that control movement, and therefore help to prevent tremor. Although lesioning is still used in some patients, it is an irreversible procedure and so is not used in the majority of patients.

Future therapies

A great deal of research is being carried out to develop new and improved therapies (including better ways of delivering the drugs) to help manage the symptoms of Parkinson's, including stem cell therapy, gene therapy, neural grafting or tissue transplants. Although these therapies will take many years to develop fully, they may eventually prove to be effective treatments for PD patients and will be an option when commercially approved even if a patient decides to proceed with DBS therapy beforehand, because it is a reversible procedure.

It is important that neurologists or PD nurses discuss all of these treatment options with their patients to ensure that they choose the right therapy that will most effectively reduce their particular symptoms.

Medtronic Deep Brain Stimulation (DBS) Therapy

Medtronic invented the first pacemaker 60 years ago in the 1950s. By applying the pacemaker technology to neurological disorders, Medtronic then developed deep brain stimulation technology in collaboration with leading physician researchers in France more than 20 years ago. Since then, the surgical technique has greatly improved and more than 75,000¹⁴ patients have received the therapy worldwide.

What information do patients need if they are considering Medtronic DBS therapy?

Certain information will enable patients to decide whether Medtronic DBS therapy is the right option for them:

- Who is a candidate for Medtronic DBS therapy?
- When should Medtronic DBS be considered?
- What are the benefits of Medtronic DBS?
- Are there any risks with Medtronic DBS therapy?

Who could be a candidate for Medtronic DBS therapy?

Certain patients will be a suitable candidate for DBS therapy. To find out more, the following questions should be answered;

1. Has the patient had PD for at least 5 years?

Yes No

2. Does the patient experience troubling off periods (periods when medication is not helping enough and symptoms are experienced)?

Yes No

3. Does the patient experience troubling dyskinesias (involuntary excessive movements)?

Yes No

4. Does the patient take frequent doses of dopaminergic drugs (Levodopa, Sinemet®, Stalevo®, Parcopa®) in a typical day?

Yes No

5. Does the patient experience any of the following troubling side effects from medications, despite having tried several drug combinations: sleepiness, nausea, hallucinations, confusion or other thinking problems, lightheadedness upon standing, behavioural/personality changes (hypersexuality, compulsory behaviour, etc.)?

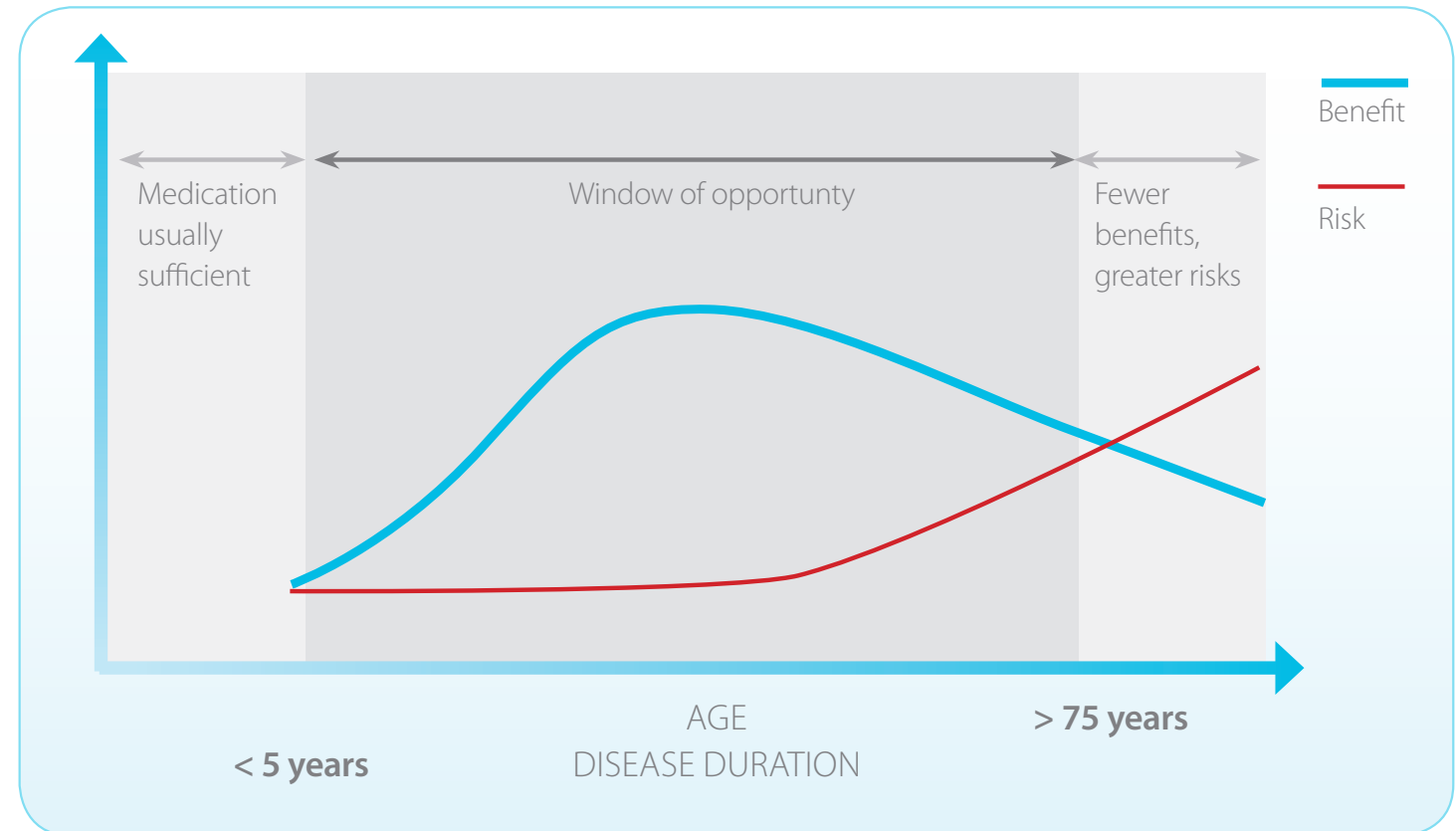
Yes No

If some of these questions were answered as “Yes”, the patient may be a candidate for this type of treatment.

When should Medtronic DBS be considered?

For optimal treatment, it is important that Medtronic DBS therapy is begun within the 'window of opportunity'. This window begins when:

- A patient has had PD for at least around 5 years, to eliminate the possibility of having another, atypical form of Parkinsonism – medication is usually sufficient before this time
- A patient's symptoms (e.g. tremor) are becoming troublesome despite optimized medication
- A patient is no longer able to tolerate the side effects of their medication
- Before PD progresses too far and it impacts on a patient's social and professional life



The benefits of DBS therapy are greatest in patients under the age of 70–75 years and in those who have had PD for a shorter amount of time. As patients age, and their PD progresses, the potential benefits of DBS therapy begin to decrease and the associated risks increase. In addition, patients whose social interaction has deteriorated too far as a result of their PD symptoms experience greater difficulties re-engaging with life when they discover that DBS therapy can make them more mobile and independent.

Therefore, Medtronic DBS therapy should not be regarded as a 'last resort', as greater benefits are observed in those who try it earlier than in those who wait until no other options are available.

It is a good idea for neurologists and patients to discuss Medtronic DBS therapy earlier in their treatment plan, even if their symptoms are still being controlled by medication. This will give them time to consider the potential benefits and possible risks of the therapy so that they can choose whether DBS is right for them when the window of opportunity arrives.

Why DBS? What are the benefits of Medtronic DBS therapy?

What Medtronic DBS therapy MAY DO for patients^{1,2,3}

- It may help them to achieve longer periods of relief from some of their motor symptoms
 - It may significantly increase the number of hours (up to 6 additional hours “on” time per day compared to pharmacological treatment only) ^{1,2,3} they spend every day without the debilitating slowness, stiffness and/or tremor characteristic of PD
 - It may significantly reduce the quantity and duration of the abnormal, involuntary movements (dyskinesia) that are a common side effect of anti-Parkinson drugs
 - It may improve their PD motor symptoms that responded to levodopa, but without the potential side effects that levodopa might produce
- It may maintain these long-term improvements in motor symptoms, even after 5 years
- It may help patients to reduce the amount of anti-Parkinson drugs that they need (by about half, in many cases)
- It may provide some relief from non-motor symptoms such as sleep disturbances and pain from muscle cramps (dystonia)
- It may improve their mobility and their ability to perform normal daily activities (such as feeding and dressing themselves, rising out of a chair, walking, etc.), thus enabling them to regain their independence and re-engage in their social life
- It may improve their quality of life and of those who may care for them
- It may provide confidence with the reassurance that DBS therapy:
 - Can offer around the clock stimulation
 - Can be programmed and adjusted to their specific needs
 - Is fully implantable and not noticeable
 - Is reversible and the system can be turned off and removed if required

What Medtronic DBS therapy WILL NOT do for patients

- It will not cure their PD – as with all current therapies for PD, DBS therapy will simply help to manage their symptoms
- It will not improve those motor symptoms that levodopa did not improve (except for tremor and muscle cramps)
- It will not solve all of the problems that patients may have developed along with their PD symptoms (e.g. social isolation, stigma, emotional problems, etc.) – DBS will help to control their motor symptoms and provide greater mobility, but it is up to them to take advantage of the opportunities that DBS can offer
- DBS does not permanently change the thinking or personality of an individual. However, DBS - like antiparkinsonian medication - may have psychiatric side effects, that are more likely to occur in patients, who have been suffering from previous psychiatric conditions due to their Parkinson's disease or drug treatment. The problems that may occur are emotional disorders, such as depression or mania, confusional states or apathy. They are overall rare and most often transient, if managed appropriately.

It is important that patients have realistic expectations of what Medtronic DBS therapy might be able to do for them. Medtronic DBS therapy may help to effectively manage their symptoms – but it will not cure their PD.



DBS was developed more than 20 years ago by Medtronic in collaboration with leading European physicians.

Are there any risks with Medtronic DBS therapy?

Medtronic DBS therapy has been proven to have a well-established long-term safety profile, particularly in younger patients under 70-75 years.^{1,3,4,5}

As with any brain surgery there are some risks associated with the procedure, but these are very low when DBS therapy is performed by an experienced team.⁵ For example, the literature indicates that 6 in every 1,000 people (0.6%) might experience a temporary surgical complication (such as a seizure or trauma to the brain tissue), while skin infections affect 4 in every 1,000 patients (0.4%).⁵ In comparison, the risk of serious complications (e.g. joint infection) after a total hip replacement is around 5 times higher (2%).⁶ When complications do occur in DBS, they are generally mild, short-lived and normally resolve around 30-90 days after surgery.⁵

The risk of permanent health impairments is also low (1.0%), mainly caused by bleeding within the skull.⁵ Like with any other treatment, deaths can occur but again the risk is low (0.4%),⁵ the same as the risk of death associated with total hip replacement (0.41%),^{7,8} for example.

There seems to be an increased risk of gait disturbances and falls with DBS therapy.³ However, it is not certain whether DBS therapy increases gait disturbances or fall risk directly, or whether patients are at a higher risk because of the improvement in their overall function and greater activity level. What is clear is that gait, balance and postural stability can improve significantly 6 to 12 months following surgery. In addition, the increased risk of gait disturbances and falls does not seem to have a negative impact on quality of life. Nevertheless, it is essential that all patients are offered physiotherapy to manage any possible gait disturbances, and that they undergo careful assessment by a multidisciplinary team before and after surgery, especially during the first year after the operation.³

Patients should be reassured that DBS therapy will not change their personality. Medtronic DBS therapy has a well-established safety record with respect to psychiatric effects in well-selected patients.^{9,10,11,12} There are no significant changes in overall cognitive performance in the long-term, and any impairments in verbal fluency and performance that may occur with DBS therapy have been shown in studies not to affect the significant improvements in quality of life. Behavioural symptoms (e.g. depression, hypomania/mania, apathy, etc.) are potentially preventable (e.g. by changing the drug dosage or stimulation, use of psychiatric therapies) and any that occasionally occur are usually short-lived and easily treatable.¹³

Neurologists with experience in DBS should discuss these issues fully with their patients as well as potential risks associated with untreated PD, anti-Parkinson drugs and other types of therapies.

This information will enable patients to balance the potential benefits of DBS therapy against any possible risks, and ensure that they choose the right therapy that will most effectively manage their specific symptoms.



To date, more than 75,000¹³ patients have received Medtronic DBS around the world
In Europe there are more than 160 specialized Medtronic DBS centers

Frequently asked questions

Is DBS therapy right for everyone?

Neurologists normally consider DBS therapy for patients who, despite optimized medical treatment, are beginning to experience significant disability when symptoms such as motor fluctuations (i.e. the so-called "off" periods) and dyskinesias interfere with normal daily activities such as holding a cup, or walking, as well as those whose medication is associated with intolerable side effects.

Not everybody with PD might be eligible for DBS. Atypical forms of PD, some mental diseases, lack of response to levodopa, etc. can be contraindication factors for this therapy. Only a team including a neurologist collaborating with a neurosurgeon, a neuropsychologist and a nurse can determine if a patient is a candidate for surgery.

Is this a new type of treatment for Parkinson's disease?

No. Medtronic invented the first pacemaker 60 years ago in the 1950s. By applying the pacemaker technology to neurological disorders, Medtronic then developed deep brain stimulation technology in collaboration with leading physician researchers in France. DBS therapy was first used for the treatment of essential tremor in Europe in 1987 and approved for advanced PD in 1998. Since then, the surgical technique has greatly improved and a new and more advanced generation of devices has become available, including a rechargeable device (Activa® RC). Worldwide, more than 75,000¹⁴ patients have received Medtronic DBS Therapy for PD, essential tremor and dystonia.

What is the success rate of DBS therapy?

The average improvement in motor symptoms is between 50-70% with up to 5.1 additional hours "on" time per day compared to pharmacological treatment only^{1,2,3}, resulting in longer periods during the day when patients will not suffer from the motor symptoms of PD. This improvement helps many patients to regain their ability to perform normal daily activities and significantly improves quality of life.

How do patients find out if they are a candidate for DBS therapy?

When considering any treatment, patients should always first talk to their neurologist to learn about all the treatment options that are available to them, to ensure that they make the right choice. When considering DBS therapy, the neurologist will go through a simple checklist that will indicate whether patients should be referred for treatment. The patient, in collaboration with their neurologist, can then decide together whether DBS therapy is the right treatment at this time.

1987 First Medtronic DBS system implanted to control disabling tremor

2003 Medtronic DBS Therapy approved in Europe for primary dystonia

1998 Medtronic DBS Therapy approved for advanced Parkinson's disease motor symptoms

2009 Medtronic DBS launches next generation of neurostimulators

1993 Medtronic DBS Therapy approved in for essential tremor and tremor in Parkinson's disease

2010 More than 75,000¹³ patients have received Medtronic DBS worldwide

Can patients undergo Medtronic DBS if they suffer from (severe) emotional problems due to other reasons?

Yes, they will still be a potential candidate for DBS. However, it is important that their emotional problems are treated before they undergo DBS, so neurologists will need to discuss these issues fully with their patients.

Is the operation painful?

The brain itself is not sensitive to pain and therefore the operation is not painful. The operation has two parts. The first part of the procedure, when the leads are positioned in the brain, may be done under general anaesthesia or using a local anaesthetic applied to the area of the scalp where the leads are inserted. This part of the surgery is done with very advanced technology to position the leads in the exact part of the brain where they are needed. During the second stage, the neurostimulator is implanted in the chest or abdominal area and is connected to the leads with a thin extension wire placed under the skin, so that the therapy remains invisible. During this stage, patients will be under general anaesthesia. Afterwards, they will require a short hospital stay (1–4 days) to recover from the surgery. Depending on the hospital, the neurostimulator will be programmed immediately or after a couple of weeks. In either case, this programming will be always tailored to the patient's medical needs over a few weeks after the operation.



Could DBS therapy cause any damage to brain tissue?

One of the great advantages of DBS therapy compared with earlier surgical procedures is that the nerve tissues in the brain are not damaged by the electrical stimulus. Instead, the stimulus stops or reduces the electrical signals produced by the brain that cause the symptoms of PD. In addition, the therapy can be reversed at any time.

Will patients feel the stimulation?

Many people with a Medtronic DBS system will not feel the stimulation at all. Some people may feel a brief tingling sensation when the device is first turned on.

Will a patient's symptoms get better immediately after the surgery?

Typically, the DBS system is not activated until a few weeks after surgery. A patient's symptoms should decrease at this point. Optimal results are not normally achieved until the healthcare professional who programs the device has gone through several programming sessions with the patient. This process may take several weeks and sometimes months.

How long does the neurostimulator last?

Depending on the model used and the amount of electrical stimulation required to control a patient's particular symptoms, the battery that supplies the neurostimulator can last from 3 to 9 years. When it is time to replace the battery, the incision over the stimulator is reopened under local anaesthesia and the old device is removed. Only the battery is replaced, with the new one just connected to the existing wires.

Is DBS therapy permanent?

DBS therapy is adjustable, so that the stimulation can be changed over time to maintain control over a patient's symptoms. The system can also be deactivated or removed if necessary.

For Ann, a Daily Victory to celebrate after DBS is being able to enjoy a cup of coffee with her husband Liam

Patient's story

Ann Keilthy is a mother of two girls and has been a teacher and a secretary.

She was diagnosed with PD when she was 44 years old. During the early years, she was a full-time mother; as PD progressed, she found it upsetting that she was no longer able to go to her younger daughter's final year parent teacher meetings in school.

At that time she had visible tremor, slowness of movement and left arm dystonia and found herself tripping when out walking.

When she was 51 she was offered DBS, and had the surgery nine months later.

"I had DBS somewhat earlier than usual at that time because I couldn't tolerate medication with L-Dopa"

"In order for me to make up my mind about DBS, I read all I could find about it on the Internet and in medical journals and decided that the odds were worth it. My quality of life was so poor it seemed the only way to go. For me, a decent quality of life is made up of the little, unimportant things, like going for a walk with my husband Liam, shopping for clothes, having a cup of tea, the ordinary little satisfying routines of life which my Parkinson's denied me"

Ann describes the effects of Medtronic DBS on her life.

"The greatest victories of all lie in the small things of life, like being able to get out of the bed in the morning, being able to put one foot in front of the other and walk, doing the best that I can during the day and finally going to bed completely independently."

Some people with PD can have difficulty with speech; medication and other treatments such as DBS may also affect speech. But several articles demonstrate that any impairments in verbal fluency and performance that may occur with DBS therapy do not affect the significant improvements in quality of life.

"My speech is softer, especially when tired, but this is a small price to pay for getting my life back."

"I would recommend that people talk to their neurologist sooner about DBS to find out if they are suitable candidates for this therapy"

Please note that all patients do not respond the same way to Medtronic DBS and patients may have a different experience to Ann.



Questions for neurologists to discuss with their patients about Medtronic DBS therapy

Below is a list of questions about DBS therapy that patients may like to discuss with their neurologist. They may also have other things that they would like to discuss, which they can record themselves underneath.

- Am I a candidate for DBS therapy? Why? Why not?
- When should I consider DBS?
- What are the potential benefits?
- Are there any associated risks?
- What are the surgical risks?
- Is it painful?
- Will I feel better immediately or will it take some time?
- Will the neurostimulator have to be replaced, and will this require further surgery?
- What types of Medtronic DBS neurostimulators are available?

Patients' own questions

References

- (1) Krack P, Batir A, Van Blercom N, Chabardes S, Fraix V, Ardouin C et al. Five-year follow-up of bilateral stimulation of the subthalamic nucleus in advanced Parkinson's disease. *N Engl J Med* 2003; 349:1925-34.
- (2) Deuschl G, Schade-Brittinger C, Krack P, Volkmann J, Schafer H, Botzel K et al. A randomized trial of deep brain stimulation for Parkinson's disease. *N Engl J Med* 2006; 355:896-908.
- (3) Weaver F, Follett K, Stern M, Hur K, Harris C, Marks Jnr W et al. Bilateral deep brain stimulation vs best medical therapy for patients with advanced Parkinson's disease. *JAMA* 2009; 301(1):63-73.
- (4) Rodriguez-Oroz M, Zamarbide I, Guridi J, Palmero M, Obeso J. Efficacy of deep brain stimulation of the subthalamic nucleus in Parkinson's disease 4 years after surgery: double-blind and open label evaluation. *J Neurol Neurosurg Psychiatry* 2004; 75:1382-1385.
- (5) Voges J, Hilker R, Botzel K, Kiening KL, Kloss M, Kupsch A. Thirty days complication rate following surgery performed for deep-brain stimulation. *Mov Disord* 2007; 22(10):1486-9.
- (6) American Academy of Orthopedic Surgeons. Total hip replacement. <http://orthoinfo.aaos.org/topic.cfm?topic=A00377> 2009.
- (7) Lie SA, Engesaeter LB, Havelin LI, Furnes O, Vollset SE. Early postoperative mortality after 67,548 total hip replacements: causes of death and thromboprophylaxis in 68 hospitals in Norway from 1987 to 1999. *Acta Orthop Scand* 2002;73:392-399.
- (8) Blom A, Pattison G, Whitehouse S, Taylor A, Bannister G. Early death following primary total hip arthroplasty: 1727 procedures with mechanical thrombo-prophylaxis. *Acta Orthop*. 2006;77:347-350.
- (9) Witt K, Daniels C, Reiff J, Krack P, Volkmann J, Pinsker M et al. Neuropsychological and psychiatric changes after deep brain stimulation for Parkinson's disease: a randomised, multicentre study. *Lancet Neurol* 2008; 7:605-614.
- (10) Parsons T, Rogers S, Braaten A, Woods S, Troster A. Cognitive sequelae of subthalami nucleus deep brain stimulation in Parkinson's disease: a meta-analysis. *Lancet Neurol* 2006; 5:578-588.
- (11) Funkiewiez A, Ardouin C, Caputo E, Krack P, Fraix V, Klinger H et al. Long term effects of bilateral subthalamic nucleus stimulation on cognitive function, mood, and behaviour in Parkinson's disease. *J Neurol Neurosurg Psychiatry* 2004; 75:834-9.
- (12) Contarino M, Daniele A, Sibilia A, et al. Cognitive outcome 5 years after bilateral chronic stimulation of subthalamic nucleus in patients with Parkinson's disease. *J Neurol Neurosurg Psychiatry* 2007; 78:248-252.
- (13) Voon V, Kubu C, Krack P, Houeto JL, Troster AI. Deep brain stimulation: neuropsychological and neuropsychiatric issues. *Mov Disord* 2006; 21 (Suppl 14):S305-27.
- (14) Data on Medtronic file.

Further information

More information about Medtronic DBS can be found by looking at the following sites:

1. European Parkinson's Disease Association

<http://www.epda.eu.com>

2. Medtronic information

<http://www.medtronic.eu/our-therapies/neurostimulators-movement-disorders/index.htm>

<http://www.activadbs.com/>

3. Rewrite tomorrow, Medtronic DBS patient stories

<http://www.rewritetomorrow.eu.com/surgery/dbs/patient-testimonials>

4. Patient online communities

www.patientslikeme.com

5. Patient Videos: "Shaken: Journey into the Mind of a Parkinson's Patient"

<http://www.youtube.com/watch?v=QFtgV1vqwiE>

6. The Parkinson's institute speech therapy

http://www.parkinsonsinstitute.org/index.php?src=gendocs&ref=SpeechTherapy&category=becoming_a_patient

7. Patients books: "Life with a Battery-Operated Brain: A Patient's Guide to Deep Brain Stimulation Surgery for Parkinson's Disease"

<http://books.google.ch/books?id=WWlcPgAACAAJ&dq=battery+operated+brain&lr=&hl=en>

Medtronic DBS Therapy

Medtronic invented the first pacemaker 60 years ago. By applying the pacemaker technology to neurological disorders, Medtronic then developed deep brain stimulation technology in collaboration with leading physician researchers in France.

Two decades of experience has enabled Medtronic DBS Therapy to treat more than 75,000¹⁴ patients worldwide with Parkinson's disease, essential tremor and dystonia.



Medtronic DBS Therapy –
Combining Quality of
Life, Confidence and
Experience for more than
20 years

Indications:

Medtronic DBS Therapy is indicated for patients with disabling tremor or symptoms of Parkinson's disease. Studies have shown that deep brain stimulation with Medtronic DBS components is effective in controlling essential tremor and symptoms of Parkinson's disease that are not adequately controlled with medications. Additionally, deep brain stimulation is effective in controlling dyskinesias and fluctuations associated with medical therapy for Parkinson's disease. Medtronic DBS Therapy is also indicated as an aid in the management of chronic, intractable (drug refractory) primary dystonia, including generalized and segmental dystonia, hemidystonia, and cervical dystonia (torticollis) for individuals 7 years of age and older. Refer to the appropriate information for prescribers booklet for contraindications, warnings, precautions, adverse events summary, patient selection, and component disposal.

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