



IHH Healthcare

NEUROSURGERY

Deep Brain Stimulation for Neurological Disorders

KEY PROCEDURE HIGHLIGHTS

1

Gold Standard Treatment:

For patients with ≥ 4 years of Parkinson's disease when medications induce adverse effects or no longer adequately control motor symptoms. ^{1,2}

2

Reversible and Non-Destructive:

Leaves brain structure intact for future alternative surgical approaches.

3

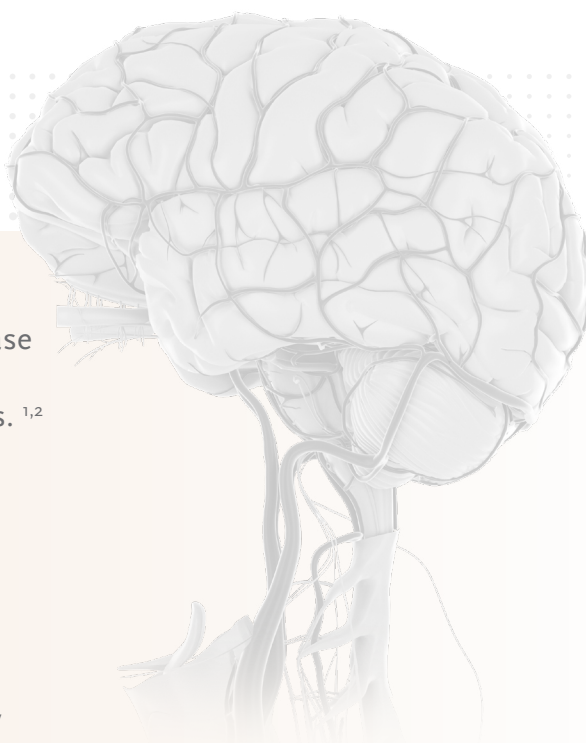
Long Term Efficacy:

Reduces motor disability and improves quality of life when combined with medication. ³

4

Highly Precise Procedure:

A millimeter error might lead to poor clinical results or adverse stimulation effects. ⁴

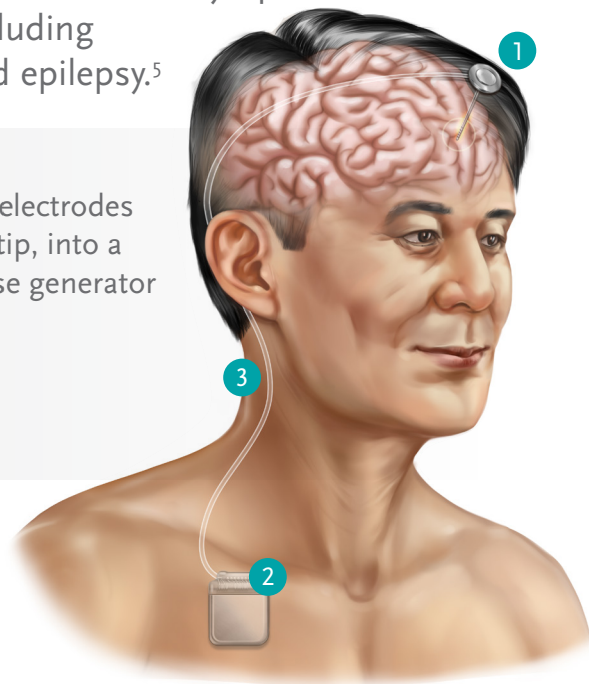


WHAT IS DEEP BRAIN STIMULATION (DBS)

DBS is a type of stereotactic neurosurgery that helps to control symptoms of medication-refractory neurological disorders including Parkinson's disease, essential tremor, dystonia, and epilepsy.⁵

DBS involves the surgical placement of ① one or two thin electrodes (lead), with four circumferential stimulating contacts at its tip, into a specific region in the brain and ② a small implantable pulse generator (IPG) placed under the skin in the infraclavicular area.

③ An extension cable connects the two components.



HOW IT WORKS

The IPG, or neurostimulator, contains the electronics that generate the stimulating electrical pulses and battery that powers the system. The continuous train of high-frequency pulses disrupts and modulate abnormal patterns of neural signalling and motor circuit activity caused by the disorders, modifying the brain's circuitry in that area.

The doctor can program several stimulation parameters of the IPG including the location, size, intensity and shape of the stimulating current field.

Appropriate **targeting** and accurate **placement** of the DBS lead with a thorough and efficient **programming** is critical for a **successful clinical outcome**.

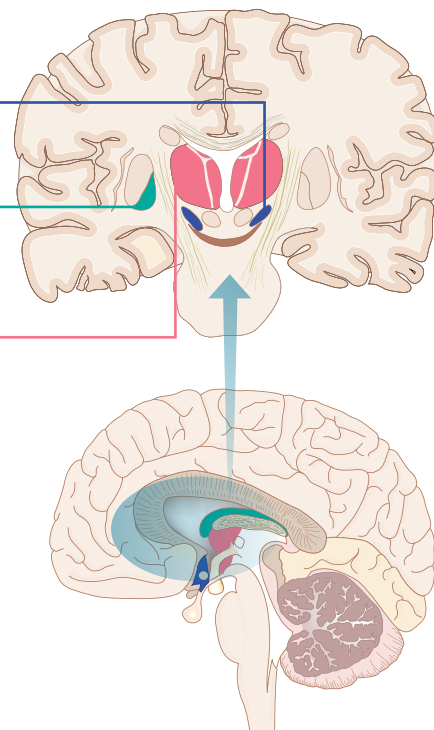
CONDITIONS ALLEVIATED BY DBS

DBS treats the symptoms of these conditions:

- ✓ Parkinson's disease (PD)*
- ✓ Dystonia[±]
- ✓ Essential Tremor (ET)*
- ✓ Epilepsy
- ✓ Obsessive-Compulsive Disorder (OCD)[±]
- ✓ Other chronic movement and neuropsychiatric disorders[∞]

Subthalamic Nucleus (STN)
Globus Pallidus Interna (GPi)
Ventralis Intermedius Nucleus of the Thalamus (VIM)

Schematic view of DBS targets



[∞] For off-label use or non-US Food and Drug Administration (FDA) approved

* Approved under Humanitarian Device Exemption (HDE) in 2003 for management of intractable, chronic dystonia for patients at least 7 years old and in 2009 for OCD

* Approved by FDA for the management of the symptoms of PD and ET

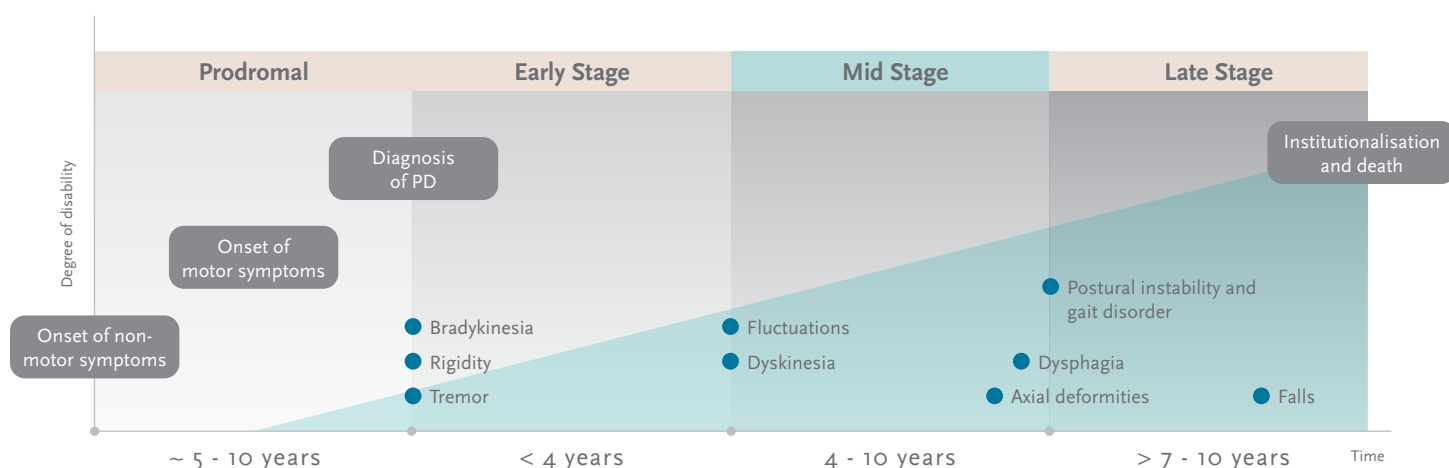
PATIENTS WHO ARE SUITABLE FOR DBS

DBS is a well-accepted alternative therapy for neurological conditions where pharmacological therapies:^{6,7}

⊗ fail to adequately control symptoms

⊗ are not tolerated due to side effects

⊗ result in motor complications



RESPONSE TO MEDICATION	Symptoms can be controlled by medication.	Symptoms cannot be adequately controlled by medication.	Symptoms no longer respond to medication.
WHEN TO FIND OUT ABOUT DBS	DBS can be considered.	DBS may be an option.	DBS is no longer an option.
WINDOW OF OPPORTUNITY		Window opens.	Window closes.

CONSIDER DBS FOR PATIENTS WITH PD AND FULFIL ALL CONDITIONS

- ✓ Diagnosis of PD for 4 years
- ✓ Levodopa responsive
- ✓ Not adequately controlled with medications
- ✓ Motor complications for ≥ 4 months (recent onset)

At the earliest stage of motor PD, DBS has been shown to slow the progression of the disease, prevent the development of late-stage complications and provide a better overall quality of life.⁸

DBS FDA APPROVAL TIMELINE⁹

1997

VIMS-DBS
approved for tremors associated with PD

2002

STN-DBS
approved for advanced PD

2003

GPI-DBS approved for advanced PD and dystonia under a Humanitarian Device Exemption (HDE)

2016

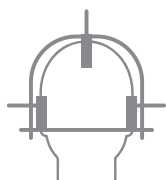
Approved **earlier DBS** for PD

A DBS PATIENT JOURNEY



1 BEFORE SURGERY

The patient is required to go for a pre-surgery brain MRI. The MRI images will be used on the day of the operation.



2 DBS LEAD IMPLANT SURGERY

A head frame is attached to the patient's head, which will be injected with anaesthesia, to ensure it is immobile and stable for precise DBS lead placement.



The patient goes for a CT scan with the head frame in place. The surgeon uses the preoperative MRI and CT images to plan the best trajectory for the entry point of the DBS lead electrodes.



Before placing the leads permanently, a test electrode is used to locate the best spot in the brain by listening through microelectrode recording (MER).



A patient under sedation is woken up and asked to perform simple motor tests, such as moving their limbs or talking.



3 IPG IMPLANT SURGERY

The patient undergoes the surgery to place the IPG (neurostimulator) beneath the collarbone.



1 - 3 weeks

Recovery Time



4 - 5 days

Average Length of Stay



4 AFTER SURGERY

The patient has his incisions checked and receives initial IPG programming. In most cases, patient's medications will be reduced.



1 - 4 weeks

Battery will be turned on.




3 - 6 months

Patient will be followed up for programming to find the best stimulation settings.

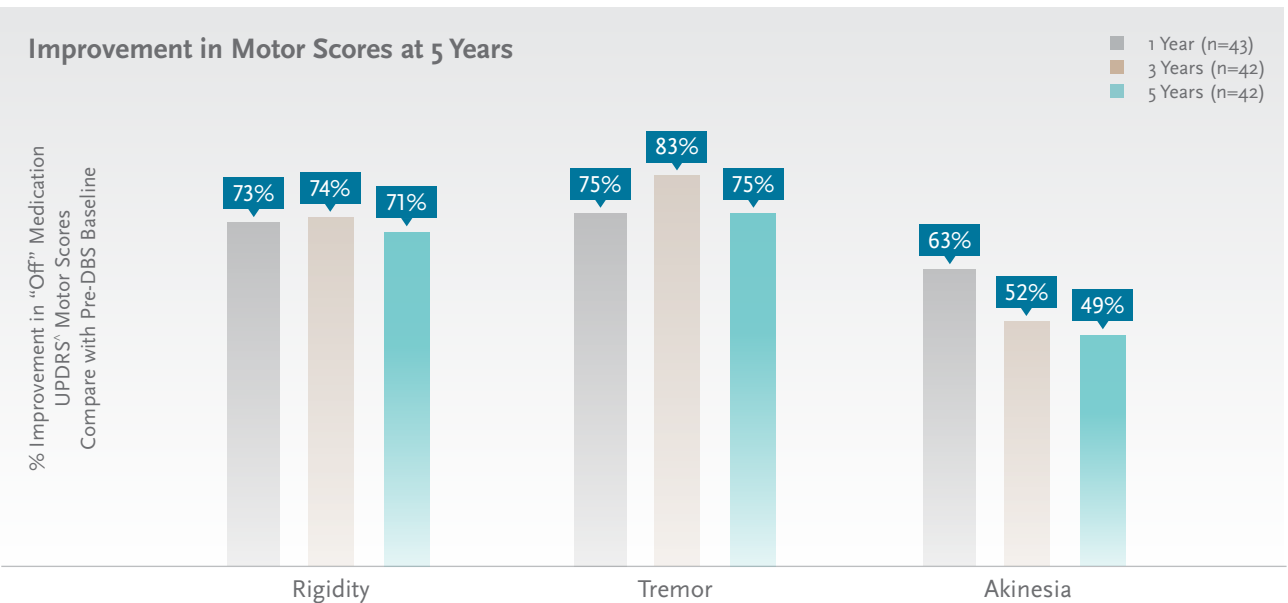
WHY CHOOSE DBS

In PD, medications may fail to consistently and adequately control the symptoms as the disorder progresses.³ A higher dosage and multiple drug therapies may increase the risk of motor complications.¹

When combined with medical therapy, DBS improves motor symptoms better than medical therapy alone at early stage of Parkinson's disease.³

MEDICATION ALONE	MEDICATION +  DBS
Minimal additional "on" time ¹³	Increase in "on" time without troubling dyskinesia ¹³
Decline in Quality of Life ¹³	Improvement in Quality of Life ¹³
Dosing compliance challenges ¹²	Reduced medication regimen is possible ¹³
Must cross blood-brain barrier	DBS is targeted and direct
Intermittent delivery	Continuous delivery with DBS
Unpredictable motor function throughout the day ¹¹	Reduction of drug therapy complications (dyskinesia and fluctuations) ¹³
Medication targets degenerated areas of the basal ganglia ¹³	DBS targets additional basal ganglia areas outside the regions of degeneration ⁷
Complications of drug therapy include dyskinesia, fluctuation, non-motor side effects ¹¹	Reduction in use of medication reduces complications ¹³
Rely on adequate GI absorption, competing with dietary amino acids ³	No GI absorption required with DBS

DBS MAINTAINS SYMPTOM IMPROVEMENTS AFTER FIVE YEARS ¹⁰



[^] Unified Parkinson Disease Rating Scale

^{*} 5-year prospective single centre study of the first 49 consecutive patients treated with bilateral stimulation of the STN

^{*} 7 patients did not complete the study: 3 died and 4 were lost to follow up.

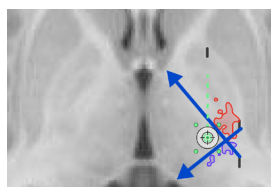
^{*} Deterioration in akinesia, axial symptoms and cognitive problems were noted over time, consistent with the progression of PD

WHY PATIENTS CHOOSE DBS AT PARKWAY HOSPITALS SINGAPORE

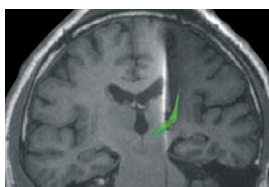
At Parkway Hospitals Singapore, patients benefit from:

✓ PREOPERATIVE CAPABILITIES

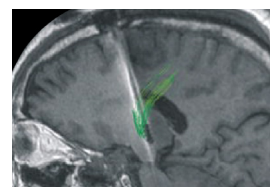
Along with our existing technologies (**3-Tesla MRI, CT Imaging**), our DBS neurosurgeon employs an innovative preoperative surgical technique – **Diffusor Tensor Imaging (DTI) tractography** – that makes it possible to target fibre tracts in the brain with pinpoint accuracy. This improves patient outcome and sees better results.^{14,15}



***BEFORE SURGERY:**
Visualize and target fibre tracts and disease-affected nodes



***AFTER SURGERY:**
Electrode with active tip precisely in fibre



***SIDE VIEW:**
DBS electrode and brain fibre shown in green

* Courtesy of Dr. Nicolas Kon KK, Neuro Asia Care

✓ MULTIDISCIPLINARY TEAM CARE

Our team of specialists work together to ensure maximum benefits from a DBS surgery. We have 40 specialists with decades of experience across neurology, neurosurgery and radiology to ensure the patient receives the best overall outcome, treatment and care.

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