



**Stanford**  
MEDICINE  
Health Care

# Neuropsychological Aspects of Parkinson's Disease & Neuropsychological Evaluation for DBS

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# Agenda

Introduction to Neuropsychology

Neuropsychological Evaluation

Neuropsychological Aspects of Parkinson's Disease (PD)

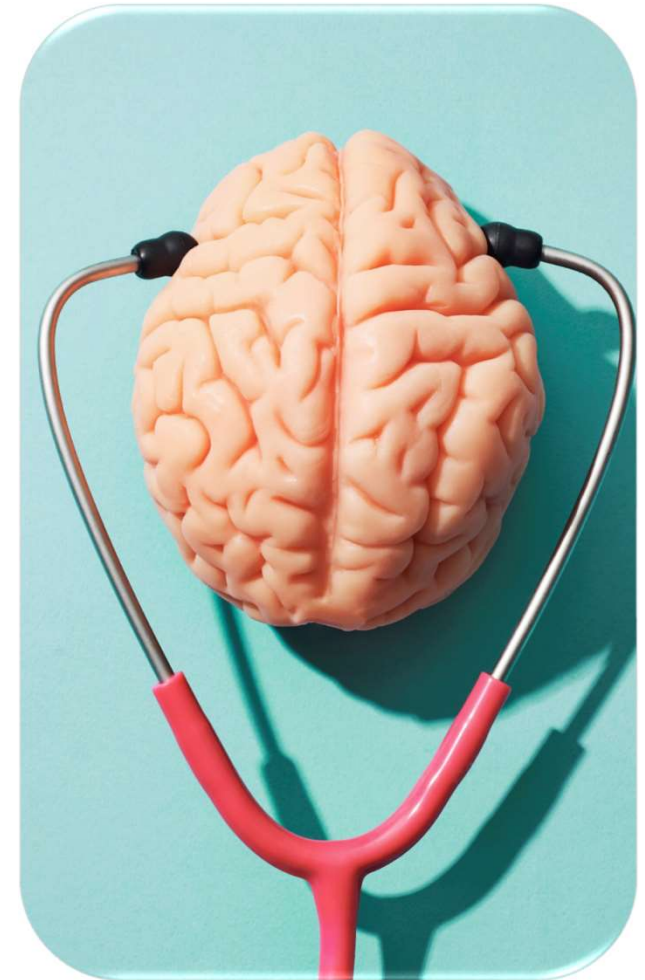
Neuropsychological Evaluation for DBS

Resources

# What is Neuropsychology?

“Clinical neuropsychology is a specialty field within clinical psychology, dedicated to understanding the **relationships between brain and behavior**, particularly as these relationships can be applied to the **diagnosis of brain disorder, assessment of cognitive and behavioral functioning, and the design of effective treatment.**” (American Academy of Clinical Neuropsychology)

Neuropsychological assessment can be thought of as “an extension of the neurological exam using **quantitative methods to characterize higher brain functions** that often do not lend themselves to identification through elicitation of pathognomonic signs in a typical neurological examination.” (Pearson et al., 2019, p. 30)



# What is Neuropsychology?

Neuroimaging (MRI, CT) - STRUCTURE



Neuropsychological Evaluation - FUNCTION



# Common Referrals

Normal aging vs. Mild cognitive impairment (MCI)

Cerebrovascular disease/stroke

Movement disorders

Neurodegenerative dementia disorders

Brain Injuries

Cancers

Multiple Sclerosis and other demyelinating disorders

Epilepsy



# Elements of a Neuropsychological Evaluation

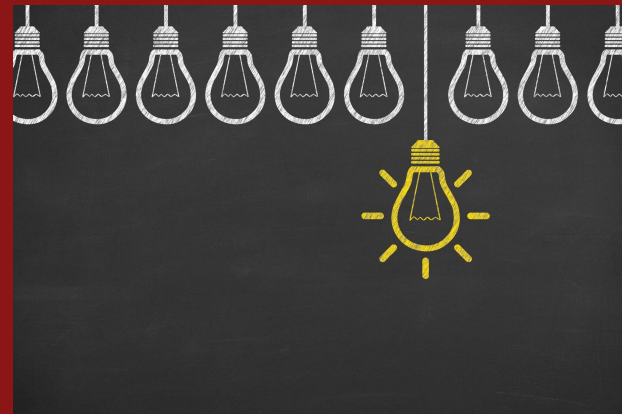
- Referral
- Chart review
- Clinical interview/neurobehavioral status examination
- Selection of tests
- Administration of tests
- Scoring and normative data comparison
- Test interpretation and report writing
- Feedback of results



# Cognitive Domains

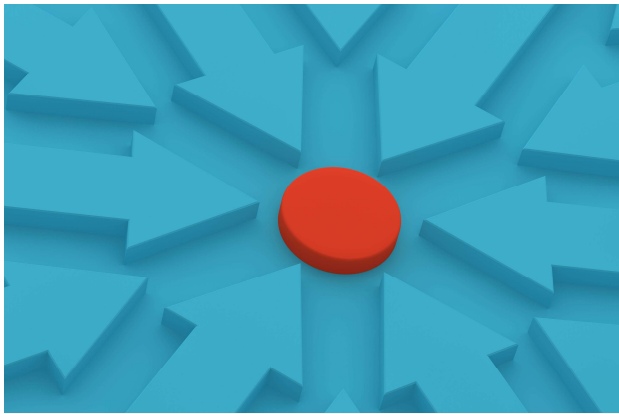


Global Cognition/Cognitive Screener



General Intellectual Function

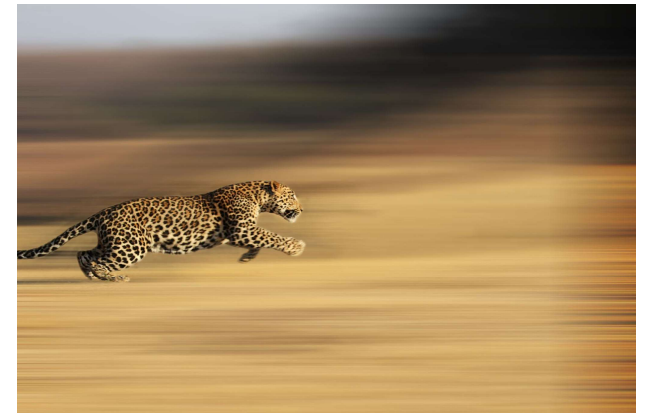
# Cognitive Domains



Simple Attention



Working Memory



Processing Speed



# Cognitive Domains



Visuospatial Function



Language Function

# Cognitive Domains



Memory

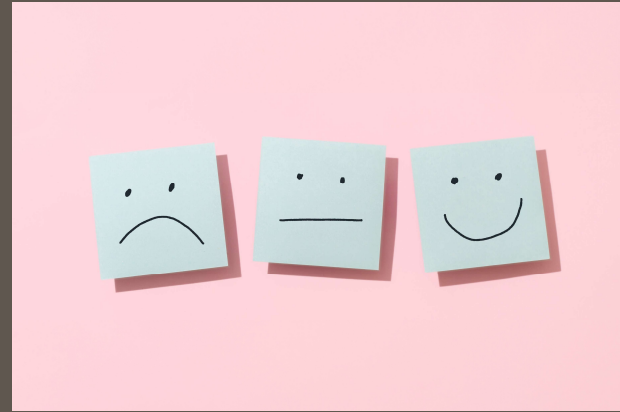


Executive Functions

# Other Domains



Motor/Sensory



Mood

AN  
ESSAY  
ON THE  
SHAKING PALSY.

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CHAPTER I.

DEFINITION—HISTORY—ILLUSTRATIVE CASES.

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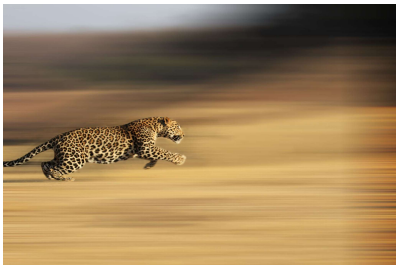
SHAKING PALSY. (*Paralysis Agitans.*)

Involuntary tremulous motion, with lessened muscular power, in parts not in action and even when supported ; with a propensity to bend the trunk forwards, and to pass from a walking to a running pace : the senses and intellects being uninjured.

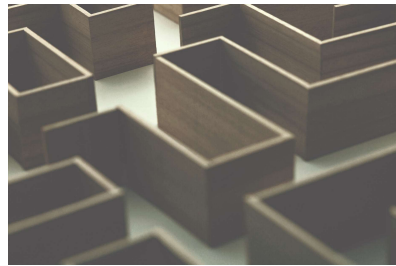
**James Parkinson, 1817**

# Cognitive Changes in PD

## Processing Speed



## Executive Functions



## Visuospatial



## Learning/Memory



# Psychiatric Changes in PD

## Anxiety

- Common (20-40%)
- Often appears before motor symptoms
- Very frequently occurs during OFF times

## Depression

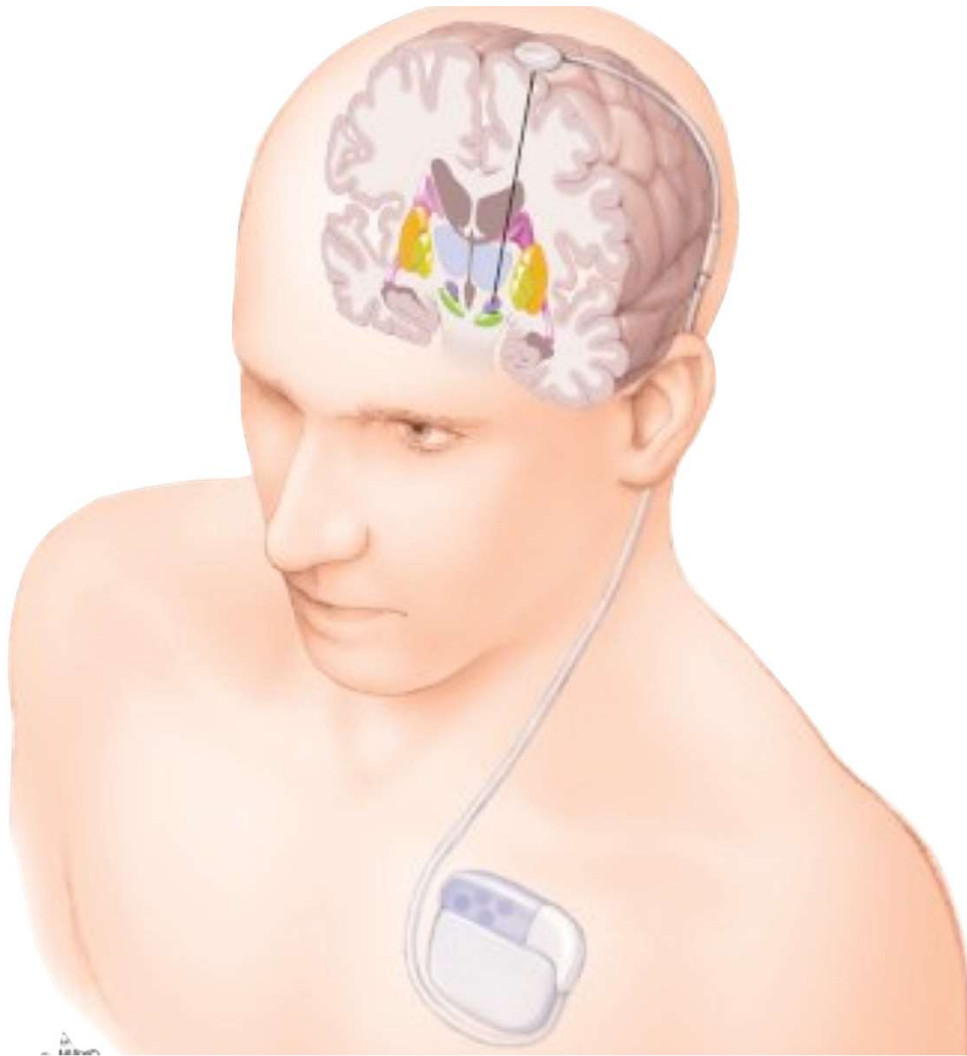
- Common (2-90%)
- Often appears before motor symptoms

## Visual Hallucinations

- Presence
- Illusion
- Hallucination

## Apathy/Impulse Control

- Apathy:
  - ~60%
  - Low motivation
- Impulse Control
  - Pramipexole, Ropinerole, Very high doses of Sinamet
  - Excessive spending, gambling, hobbying, medication use, eating, sexual activity.



## Deep Brain Stimulation (DBS)

Deep brain stimulation (DBS) involves implanting electrodes within areas of the brain involved in Parkinson's disease (basal ganglia). The electrodes produce electrical impulses that affect brain. The brain electrodes are connected to a battery which is implanted underneath the skin below the collarbone. The battery provides the energy to deliver electricity through the electrodes.

## Benefits of DBS

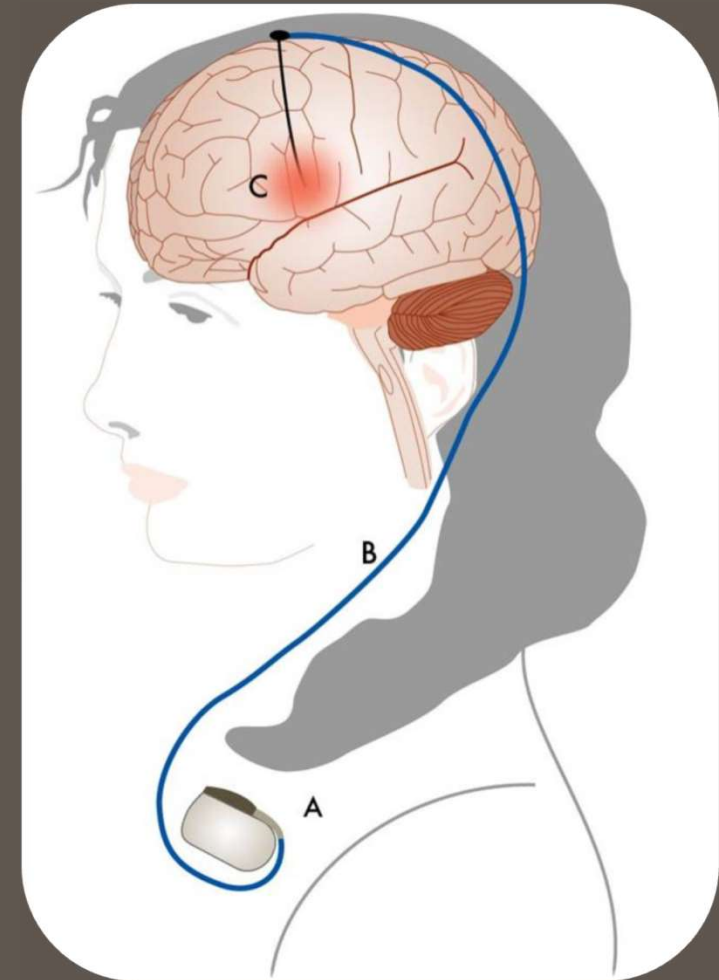
- tremor reduction
- reduced dyskinesias
- “smooth out” motor fluctuations (ON-OFF)
- improved stiffness and rigidity
- medication reduction (sometimes)
- best predictor: which symptoms respond to dopamine therapy





## Benefits of DBS

- Studies show sustained motor benefits for 5 years
- Associated with improvements in quality of life
- Does not act as a cure or benefit non-motor symptoms (cognition, mood, autonomic).



# Neuropsychological Evaluation for DBS

## COGNITIVE

- Attention
- Working memory
- Processing speed
- Visuospatial
- Language
- Learning and memory
- Executive functions

## OTHER HEALTH FACTORS

- Mood
- Sleep
- Pain
- Head injuries
- Medical history
- Family history
- Social history

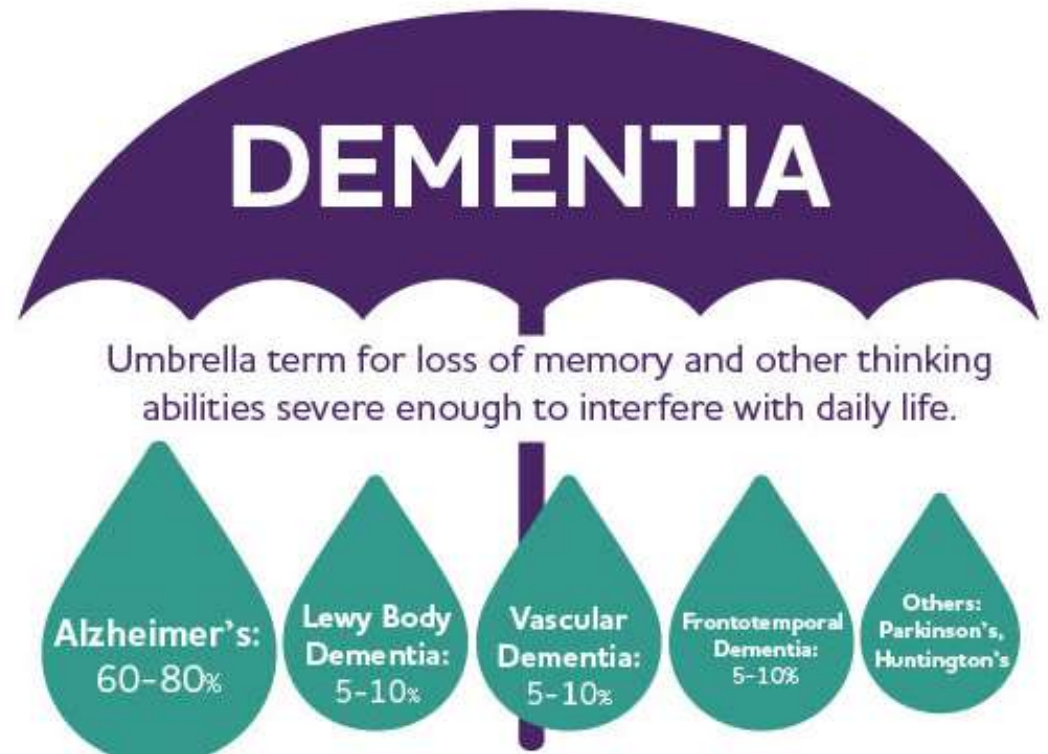
## DBS

- Understanding of the process
- Expectations
- Support





No evidence of dementia





## **DBS Review Board/Case Conference**

Team meeting to discuss candidacy for DBS

# Resources

- <https://www.apdaparkinson.org/>
- <https://www.nia.nih.gov/health/parkinsons-disease>
- <https://www.caregiver.org/resource/parkinsons-disease-caregiving/?via=caregiver-resources,health-conditions,parkinsons-disease>
- [International Parkinson and Movement Disorder Society: www.movementdisorders.org](http://www.movementdisorders.org)



## Exercise for Parkinson's Disease: Essential Facts for Patients

### WHY IS EXERCISE IMPORTANT?

Movement, slowness, and stiffness can be difficult when you live with Parkinson's disease (PD). Slowness in particular can make you feel weak and is very unsatisfying. Adding regular exercise may improve your overall mobility and quality of life.

### WHAT IS THE ROLE OF EXERCISE IN PD?

Exercise is a planned, structured and repetitive physical activity. It is a complement to:

- Other physical activity
- Medications
- Surgery
- Physical therapy
- Occupational therapy

Exercise programs can help you stay active and support your daily living activities. Be sure to define your goals before you begin a program. It is important for patients to conduct their exercises during an 'on' period when possible.

### HOW DOES EXERCISE BENEFIT THINKING AND MEMORY?

The brain can form and reorganize connections. It's known as neuroplasticity. There is some evidence that exercise may improve neuroplasticity. Exercise can help improve attention, thinking and memory. Physical activities may benefit brain areas related to learning. This effect is more obvious in early disease phases. To increase exercise's benefit, include:

- Physical or spoken feedback
- Attention tasks, such as walking and doing a memory test at the same time
- Motivational rewards

### WHAT MOTOR SYMPTOMS OF PD CAN IMPROVE WITH EXERCISE?

Patients often complain about difficulties with walking, mobility, posture, and balance as PD advances. These symptoms may improve with exercise. The risk of falls may also decrease.

### DOES EXERCISE HAVE ANY ADDITIONAL BENEFITS?

Exercise may improve movement, thinking and memory function. You may also find exercise can have a positive impact on your physical appearance, mood, and social interactions. You may experience:

- Better arm and leg strength
- Core muscle strength
- More muscle flexibility

### WHAT TYPE OF EXERCISES ARE RECOMMENDED?

There is no exercise that clearly is better than another. The most important thing is to do exercise that you enjoy and will continue. This can include cardio exercise (exercise cycle, elliptical machine) and light lifting of weights. Do not overdo exercise or put yourself at risk for falling. Researchers have studied and recommend several exercises for people with PD. Some examples include:

- Tai chi
- Tango dancing
- Exercising on a treadmill or elliptical machine
- Cycling

### WHAT SYMPTOM-SPECIFIC EXERCISES ARE RECOMMENDED?

- **Tai chi.** This exercise helps posture control. It can also improve control of your center of gravity, reducing the risk and number of falls.
- **Tango dancing.** This activity supports your body and brain. It can help increase coordination with a partner, spatial awareness and ability to focus.
- **Exercising on a treadmill or elliptical machine.** This may improve how you walk, step or run (your gait). It may also help improve your speed, stride length, balance and gait rhythm. Adjust the speed and slope to make this exercise more effective. However, be very careful about falling.

**Cycling.** It may help to improve the walking speed and cadence. It is important that you talk to your doctor before beginning an exercise plan.



## Deep Brain Stimulation for Parkinson's Disease: Essential Facts for Patients

### WHAT ARE THE MOTOR SYMPTOMS OF ADVANCED PARKINSON'S DISEASE?

When patients first start taking their Parkinson's disease (PD) medicines, the benefits usually last throughout the whole day. However, as PD worsens, the patient may notice that the benefit from the medicine doesn't last until the next dose, this is called "wearing off". When the medicine wears off, PD symptoms such as tremor, slowness, and difficulty walking may reappear. When the medication is taken again the symptoms improve again and the good period is called an "ON" period while the bad period is called "OFF". Patients may also develop involuntary movements (twisting and turning) called dyskinesias, which may be troublesome.

### WHAT CAN HELP ADVANCED DISEASE?

Your doctor can adjust your medication dose and the timing of the medications to try to reduce OFF periods and dyskinesias. In some patients Deep Brain Stimulation (DBS) is used to treat patients with OFF periods and/or dyskinesias that are not controlled with changes in medication. DBS is a type of brain surgery where a thin, insulated wire (also called an electrode) is placed deep in the brain. The electrode is connected to a pacemaker-like device that is placed under the skin in the chest. The device sends electrical signals to an area in the brain that controls movement. The stimulation of this brain area can improve OFF periods and can reduce dyskinesias.

### WHO SHOULD CONSIDER DBS?

When a PD patient still has a good benefit from medication but also bad OFF periods and/or troublesome dyskinesias, despite changes in the medication dosing and timing, then DBS may be an option. Good candidates also need good social support.

Patients who may not be good candidates include those with: Serious memory problems, hallucinations, severe depression and significant imbalance when walking even when ON.

### HOW ARE PATIENTS CHOSEN FOR DBS?

Your doctor should refer you to a specialized neurosurgical center for a DBS consultation. In most DBS centers, the evaluation will include:

- An evaluation by a neurologist who specializes in treating PD
- A brain scan (MRI or CT) to be sure there are no brain changes that might prevent surgery
- A consultation with a neurosurgeon who performs the DBS surgery
- A thorough evaluation including memory and thinking

### IS IT SAFE?

In general, DBS is a safe procedure. However, there are potential serious side effects such as bleeding or stroke at the time of surgery. There are also potential side effects from the stimulation (that may be reduced by changing the stimulator settings.) Most side effects are mild and temporary, such as: Weight gain, difficulty finding words, decreased quality of speech and pacemakers or electrode infections. However, there have been reports of an increased risk of suicide.

### WHAT IS THE PROCEDURE?

The DBS surgical procedure usually takes several hours. You will be awake most of the time. For most patients, one electrode is placed in each side of the brain. A frame holds your head (skull) during surgery so the electrode can be placed precisely. A small hole is drilled in each side of the skull so the electrodes can be placed. Afterward, each of the two electrode wires is tunneled through the skin and connected to a pacemaker-like device (called a neurostimulator) that is placed under the skin in the chest.

### WHAT HAPPENS AFTER THE PROCEDURE?

After DBS, your doctor will need to determine the best adjustment for stimulation settings with a device that communicates with the neurostimulator and your medication. Usually the optimal adjustment is reached three to six months after the procedure.

### WHAT ARE THE SHORT- AND MEDIUM-TERM RESULTS?

Patients may experience these benefits with DBS treatment:

- Shorter time spent in the OFF period
- Shorter length and severity of dyskinesia
- Lower medication doses
- Improved non-movement symptoms such as pain, sadness, or sleep
- Improved quality of life

### WHAT ARE THE LONG-TERM RESULTS?

Over time, DBS can continue to improve ON periods and dyskinesias. However, DBS doesn't cure PD or stop its progression.



International Parkinson and  
Movement Disorder Society

## Cognitive Impairment and Behavioral Problems in Parkinson's Disease: Essential Facts for Patients

### WHAT TYPES OF COGNITIVE PROBLEMS CAN HAPPEN IN PARKINSON'S DISEASE?

Many people with Parkinson's disease (PD) have good memory and thinking (cognition) and function normally. However, while forgetfulness may occur with normal aging more serious trouble with attention, thinking, and memory can occur as PD advances.

Common cognitive problems in PD include difficulty with:

- Paying attention or concentrating
- Planning events, like organizing a busy day
- Following a complicated conversation or solving complex problems
- Forming thoughts quickly
- Remembering events or event details, although hints or clues often bring the memory back

When changes are small, without a serious effect on your daily life, this is called **mild cognitive impairment**. When changes are severe enough to affect day-to-day activities, this is called **dementia**.

### WHY DO COGNITIVE PROBLEMS HAPPEN?

Changes in mental ability happen as PD starts to affect the parts of your brain that control attention, thinking, and memory. In most cases, this only happens later in the disease, or as people age, usually over age 65.

### HALLUCINATIONS AND DELUSIONS

Many people with PD who have cognitive impairment can also have hallucinations or delusions. Hallucinations are when people, while awake, see or hear things that are not really there. In PD, hallucinations are mostly visual. They may include "seeing" animals or people that are not there. At first, most people recognize that hallucinations are not real. Later on, it may become harder to tell what is real and what is not. PD patients may also have illusions such as thinking a spot on the wall is an insect.

**Delusions** are false beliefs that are not based on reality or fact. Common delusions include thinking there are extra people living in the house, your spouse is cheating, or someone is stealing from you. This usually happens in more advanced PD.

Mild hallucinations that you easily recognize as hallucinations do not need treatment. It is important that your doctor checks that you do not have an infection, especially of the urinary tract, or you are not on a medication that can cause hallucinations and delusions. Hallucinations and delusions often can be treated by adjusting medications, like those for sleep or pain. If these problems continue despite these changes, your doctor may try reducing some of your PD medications. If that does not help, or it makes your movement worse, then your doctor may prescribe medication used to help cognition. In addition, clozapine or quetiapine may help hallucinations or delusions but may cause sleepiness as a side effect. Clozapine also requires regular blood testing.

### WHAT CAN I DO FOR COGNITIVE PROBLEMS?

Cognitive function may be helped with proper exercise, diet, sleep and blood pressure control.

Talk to your doctor if problems with thinking, memory, or making decisions start to affect your daily routines. Your doctor may want to do cognitive tests. Review your medications as medications used to treat PD or other medical conditions sometimes make cognition worse. Using pill boxes and medication reminders may help.

If memory problems become severe then:

- Discuss with your family and doctor plans for future living arrangements, including home care or a care facility.
- Let a trusted caregiver have power of attorney, depending on local legal requirements. If you are no longer able, this person will have the right to speak for you, arrange your finances, pay your bills, and more. Without a power of attorney, these needs can quickly become complicated and expensive.
- Be sure your estate and will are current. You will not be able to change your will if you have severe, cognitive problems.

### ARE THERE TREATMENTS?

Some medications can help and have been studied in PD patients with dementia. They include rivastigmine, donepezil, galantamine and memantine.

Some people who take these medications notice good improvement while others notice little change. Common side effects of these medications are nausea and diarrhea.

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