Advances in Deep Brain Stimulation for Movement Disorders

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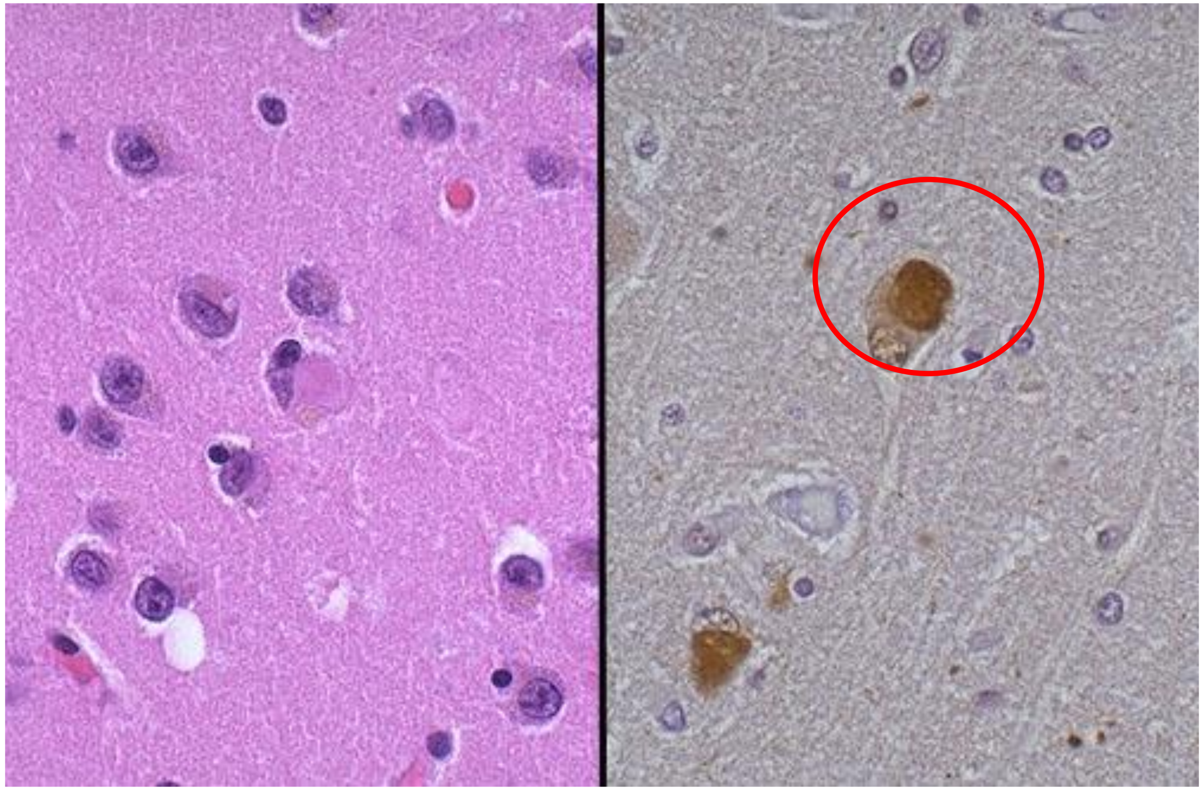
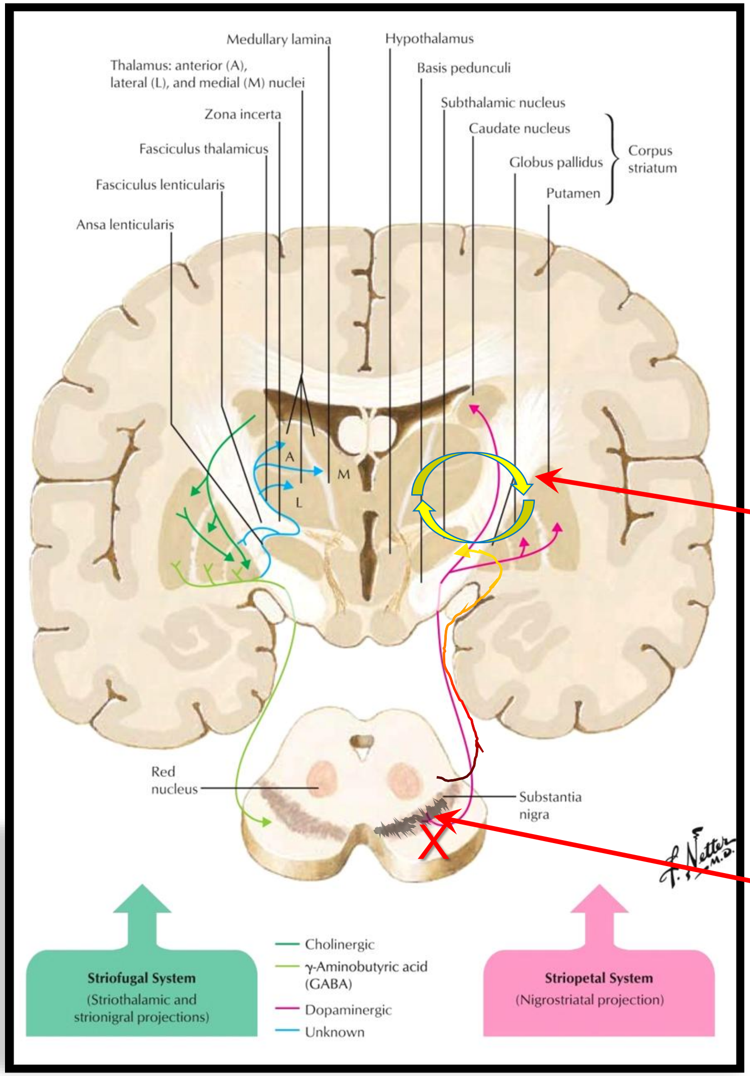
Cleveland Clinic

How Parkinson’s Affects the Brain

Lewy bodies form in the brain





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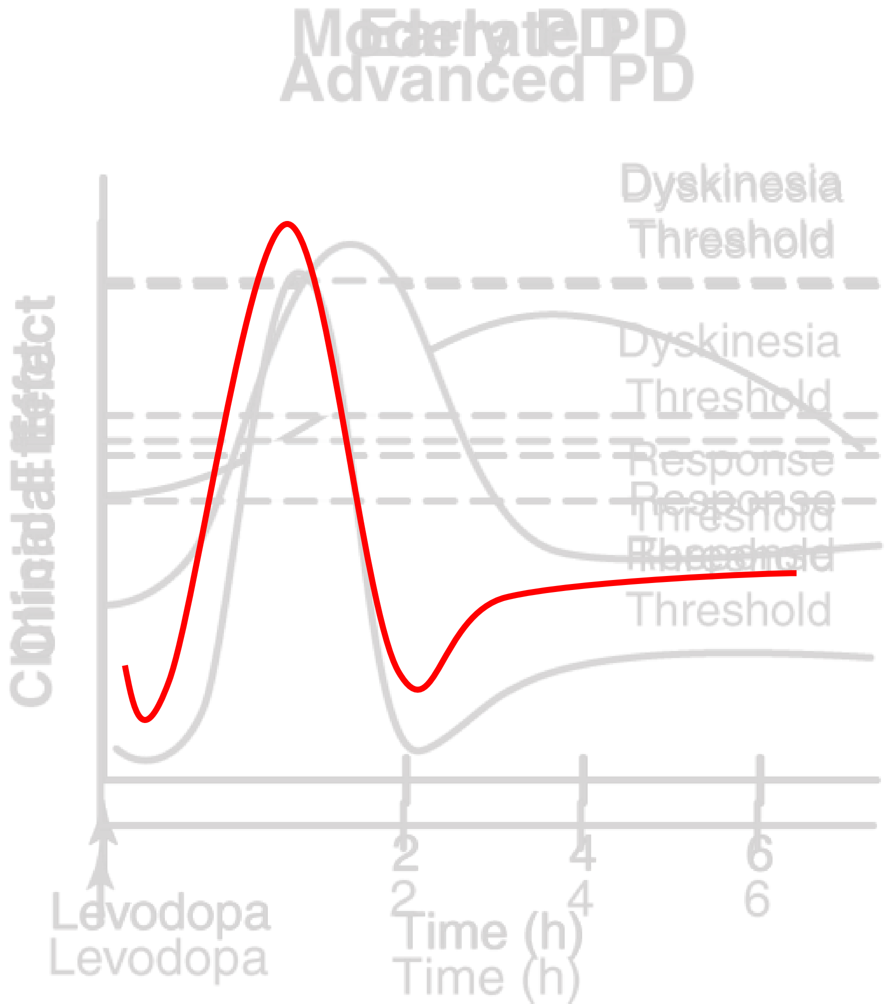
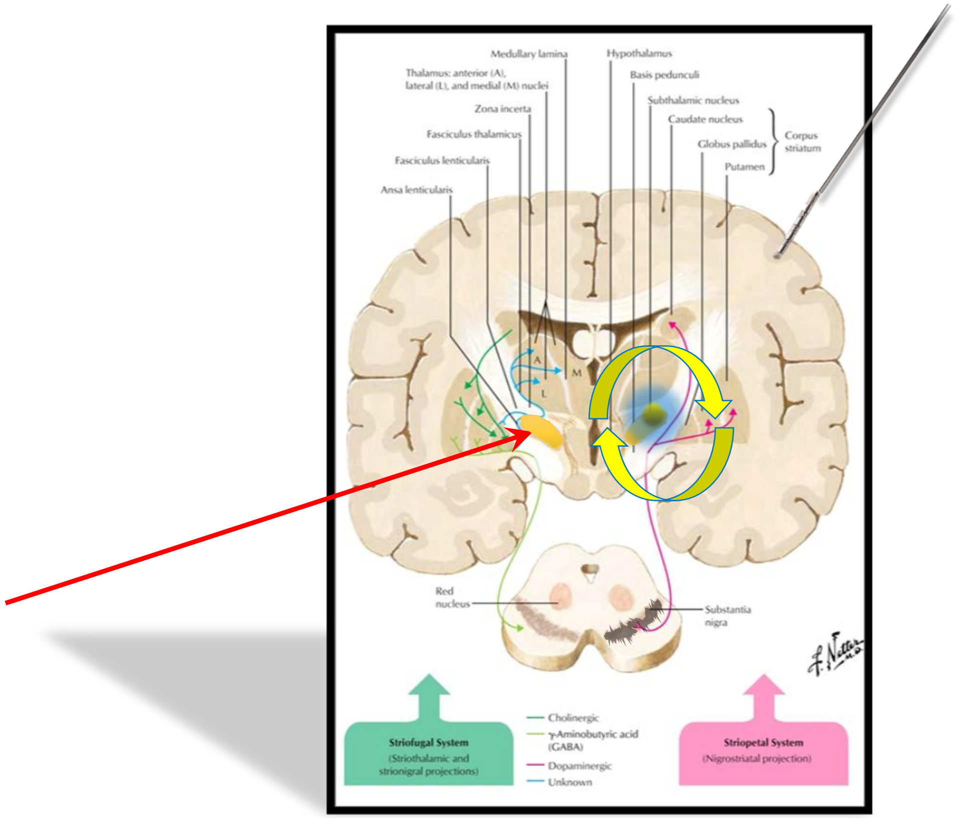
Therapeutic Window of Levodopa



A Broken Circuit puts the break on movement in Parkinson’s Disease



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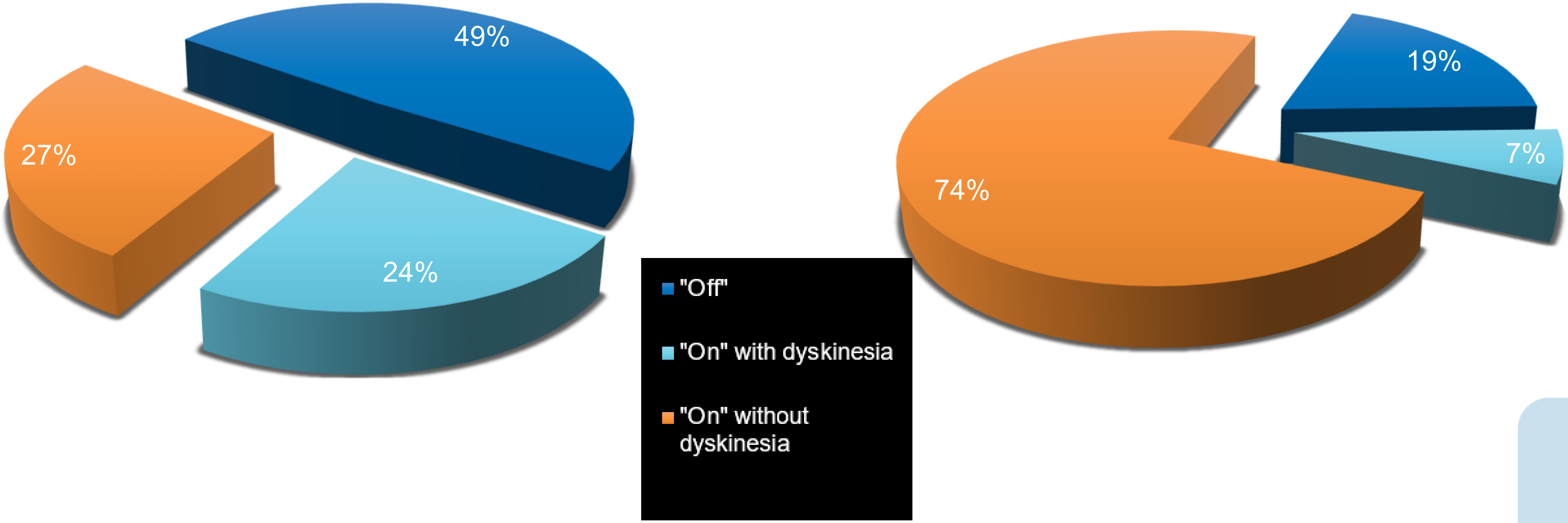
DBS gives you ½ the day back



Deep-Brain Stimulation for Parkinson's Disease Study Group. Deep-brain stimulation of the subthalamic nucleus or the pars interna of the globus pallidus in Parkinson's disease. N Engl J Med. 2001 Sep 27;345(13):956-63.

Who is a DBS candidate?

- ✓ “Idiopathic” Parkinson’s disease
- ✓ Originally good response to Sinemet (levodopa)
- ✓ No longer satisfied with response from levodopa due to any of the following:
  - Shortened or unpredictable medication response
  - Tremor
  - Stiffness
  - Slowness
  - Dexterity
  - Dyskinesia
- ✓ No significant depression, anxiety or memory loss

What We Think About...

1. Does the patient have “Idiopathic PD” rather than a parkinson's plus syndrome
2. What does the patient expect to get from surgery? – Is there a reasonable expectation that surgery will help?
3. Have medications been tried adequately?
4. How do the predictors for good and bad outcome weigh in the patient?

When are medications not enough?

- Despite medication adjustments patient still has:
  - Early wearing off before next dose of medication
  - Frequent cycling between on and off
  - Tremor that does not respond to medication
  - Troubling dyskinesias
  - Medication side-effects

What are realistic expectations from surgery?

- Improved Tremor
- Improved Dyskinesia
- Less ups and downs
- Longer lasting benefit through the day
- Improved slowness
- Improved dystonia (cramps)
- Reduction in medication
- Improved off freezing

What are not realistic expectations from surgery?

- Improved “on-freezing”
- Improved balance and walking trouble
- Improved memory
- Improved swallowing or bladder function
- Improved blood pressure control (orthostasis)
- Improved midline symptoms


What are your goals?

What is most important!

- The patient gets from surgery what they anticipated from it

Harsh reality is always better than false hope.

Julian Fellowes

Start with the facts, accept that you've got options and then get focused on turning hope into reality.

Mark Pollock

What is the Process?

1. Movement Disorders Specialist Evaluation
2. Levodopa Response Testing
3. Assessment of Goals for Surgery
4. Neuropsychology Evaluation
5. Neurosurgery Evaluation
6. Brain MRI
7. Multidisciplinary Assessment & Final Recommendation
8. Pre-Anesthesia Testing
9. Stage I – Implantation of Pacemaker Wires
10. Stage II – Implantation of Pacemaker
11. Programming

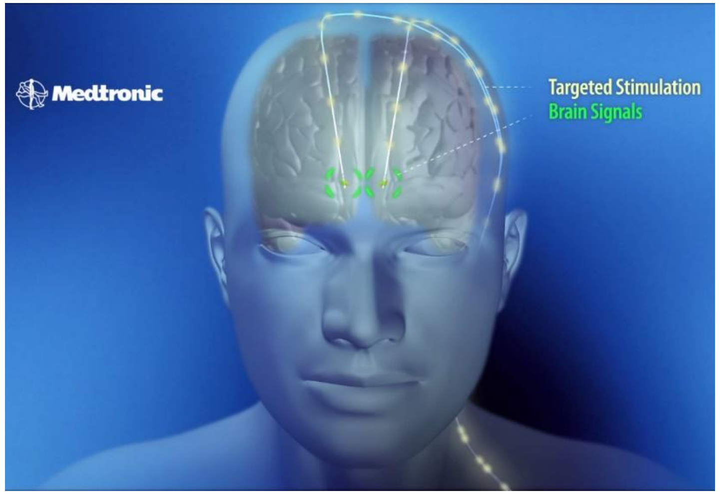
What Options Exist for Patients

Boston Scientific
Advancing science for life™

Medtronic

Abbott

MRI Options in DBS



- Medtronic – 3T
- Abbott – 1.5T
- Boston Sci –1.5T

- **Medtronic**

•The only 3T and 1.5T MR Conditional† directional DBS systems.

•Percept™ PC and RC batteries allow DBS therapy to remain ON during an MRI scan.

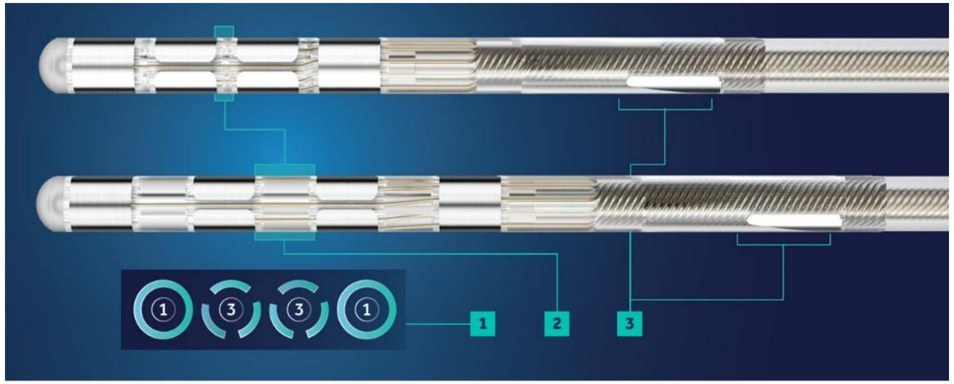
•No restrictions on prone position for breast scans with Medtronic DBS systems[1]

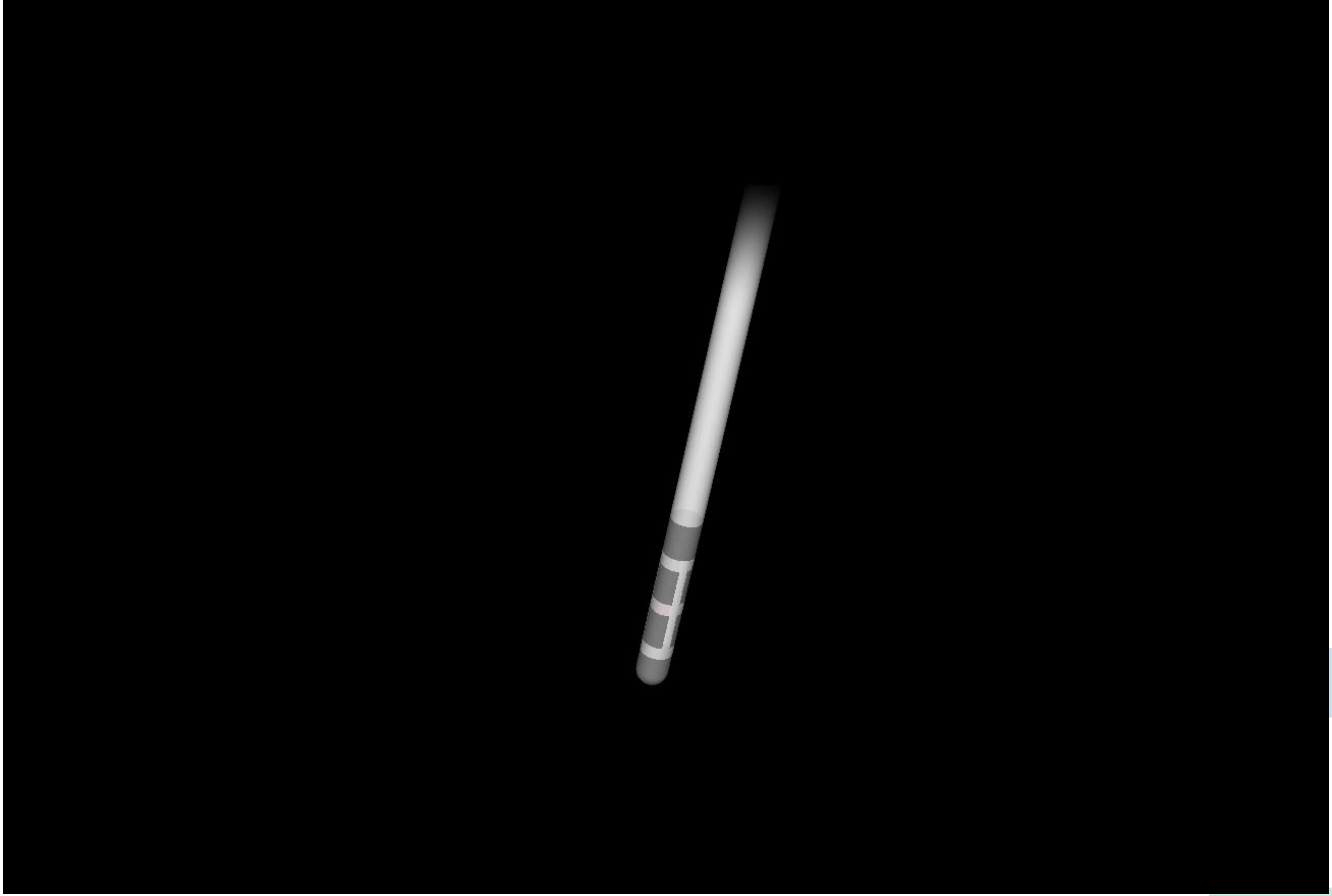
Directional Leads

Abbott

Boston Scientific

Medtronic





Rechargeable Batteries

15 year battery life vs. 3-5 years for primary cell

Medtronic
PERCEPT RC
rapid recharging from 10% to 90% full charge in less than 1 hour.
15 years
Lowest profile
The typical number of days before needing to recharge can be up to 9 to 12 days
If charging daily, recharging can take as little as 15 minutes
Proprietary Battery – minimal capacity loss
BrainSense

Boston Scientific	Abbott
Vercise Genus	Liberta RC
15 years	10 years
30 days of recharge-free therapy	lasts for 37 days on nominal settings
	world's smallest rechargeable deep brain stimulation implantable pulse generator with remote programming capabilities

Remote Programming

- Only offered by Abbott
- Dependent on Internet connection of patient – remote patient may be at significant disadvantage
- Payment issues

Adaptive Deep Brain Stimulation (aDBS)

- aDBS is cutting-edge treatment for Parkinson's disease that utilizes real-time brain activity to adjust deep brain stimulation (DBS)
- aDBS continuously monitors brain activity and adjusts the stimulation amplitude based on a specific frequency.
- aDBS allows for more personalized therapy for patients

ADAPT-PD

Key findings from the ADAPT-PD trial

•**Effectiveness:** aDBS was found to be effective, helping patients achieve better "on-time" (symptom-free time) compared to continuous DBS settings.

•**Safety:** The trial found the long-term at-home aDBS therapy to be safe and tolerable for patients whose symptoms were already stable with continuous DBS.

•**Personalized approach:** aDBS uses closed-loop technology to continuously monitor brain activity and adapt the stimulation to the patient's needs. Specifically, it can "listen" to and tune down the abnormal beta rhythms associated with stiffness and slowness in PD.

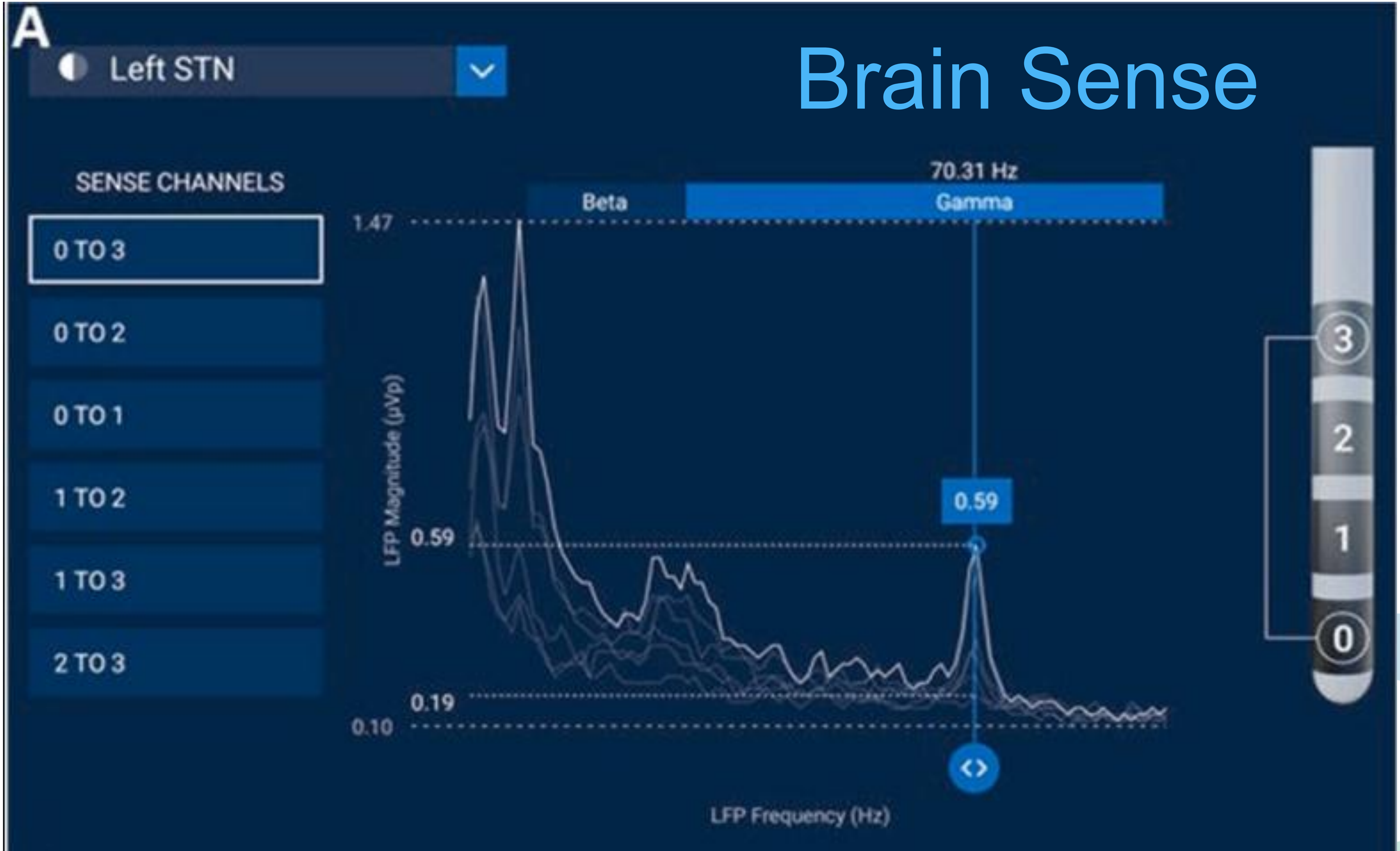
•**Patient preference:** A majority of participants indicated a preference for aDBS over their previous continuous DBS settings due to improved motor symptoms and reduced symptom fluctuations.

•**Reduced energy use:** The system's ability to adjust stimulation in real-time can lead to a significant reduction in the amount of electrical energy delivered, suggesting the potential for longer battery life in the device.

ADAPT-PD

- The prespecified primary outcome was met as 95% of patients receiving DT-aDBS and 87% of those receiving ST-aDBS had on-time without troublesome dyskinesia comparable to continuous DBS
- DT-aDBS improved on-time without troublesome dyskinesias by 1.3 hours per day and reduced off-time by 1.6 hours per day compared with standard continuous DBS.
- Total electrical energy delivered was reduced by 15% with ST-aDBS compared with continuous DBS, and no different from DT-aDBS. Over time, this could translate into longer battery life for implantable devices

Brain Sense


A
Left STN
SENSE CHANNELS
0 TO 3
0 TO 2
0 TO 1
1 TO 2
1 TO 3
2 TO 3
70.31 Hz
Beta
Gamma
1.47
0.59
0.19
0.10
0.59
LFP Magnitude (µVp)
LFP Frequency (Hz)
3
2
1
0

Both
Apr 2022
Marked Event
Parameter Change
14
Left STN
LFP
mA
Right STN
LFP
mA
12am
6am
12pm
6pm
11:59pm

Adaptive DBS = Osteopathic Medicine

- **Restoring function** - Instead of relying on often-harmful 19th-century drugs, Dr. Still's osteopathic manipulative treatments (OMT) aimed to adjust misaligned bones, muscles, and nerves to restore normal function and allow the body to heal itself
- Adaptive DBS is "replacing" the brain's ability to function properly.

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100 YEARS

EST. 1921

THE FUTURE OF HEALTHCARE

SINCE 1921