

# School for Device-Aided Therapies in Parkinson's Disease

Bangkok, Thailand | May 6-7, 2026



International Parkinson and  
Movement Disorder Society  
Asian & Oceanian Section

# OVERVIEW OF DBS PARAMETERS AND INITIAL PROGRAMMING BASED ON CLASSIC CLINICAL THRESHOLD

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# INTRODUCTION

## ROLE OF NEUROLOGIST IN DBS



-> DBS programming allows to optimize symptom control and minimize stimulation-related side effects

# INTRODUCTION

## BENEFITS OF DBS PROGRAMMING IN PARKINSON'S DISEASE

1. Optimize Motor Symptom Control: Robust improvement in motor symptoms (30–60% UPDRS III)
2. Reduce Medication Burden: 30 – 50%
3. Improve Quality of Life
4. Sustain long-term benefit in well-selected patients

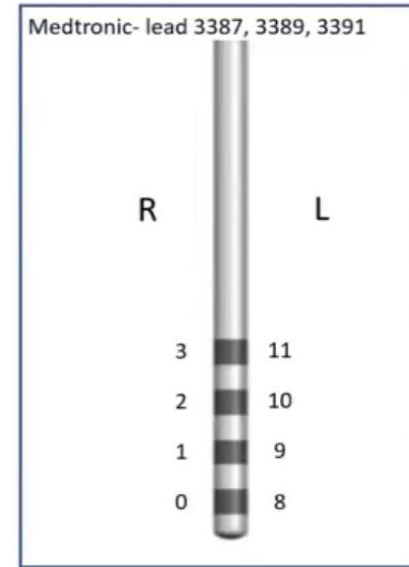
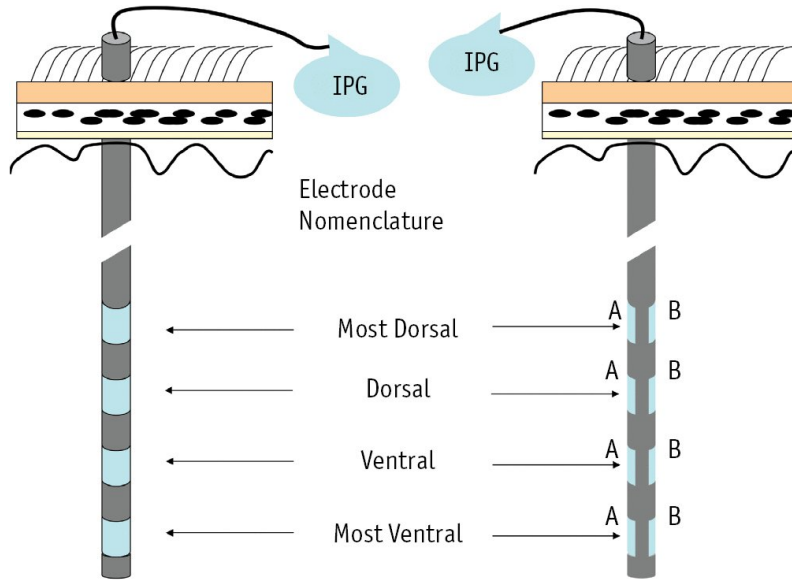
# INTRODUCTION

## HOWEVER:

1. DBS is highly effective — but not uniformly optimal
2. Substantial inter-patient variability
3. Not all patients achieve optimal functional outcomes
4. DBS programming is still not fully standardized
5. Up to ~40% of suboptimal outcomes

# BASIC PARAMETERS OF DBS

## DBS LEAD ELECTRODE



# BASIC PARAMETERS OF DBS

## Pulse Width

( $\mu$ sec)

**RANGE: 20 – 450  $\mu$ s**

duration of each stimulus



## Amplitude

(Volts or mA)

intensity of stimulation

**RANGE: 0 – 25.5mA**

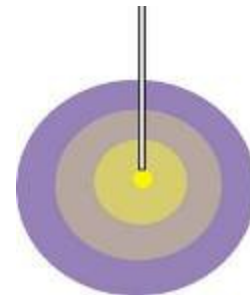


## Rate

(Hertz)

number of pulses  
per second

**RANGE: 1 – 250Hz**





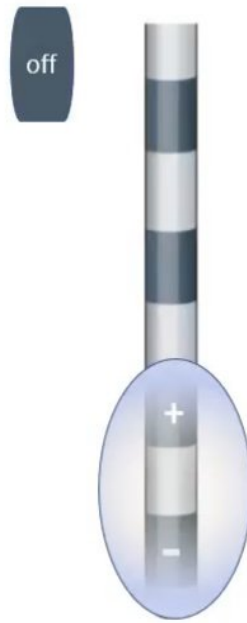
# ELECTRIC CONFIGURATIONS

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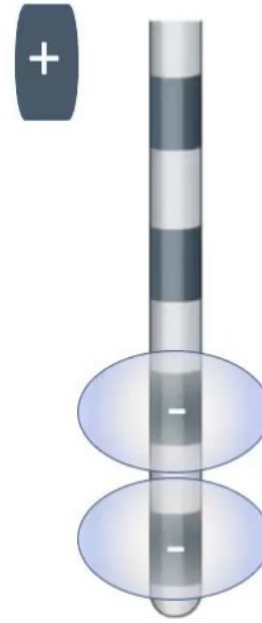
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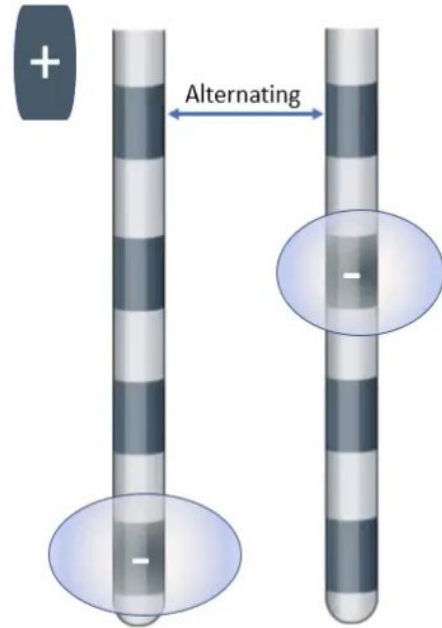
Unipolar



Bipolar



Double Unipolar



Interleaving/ MSS

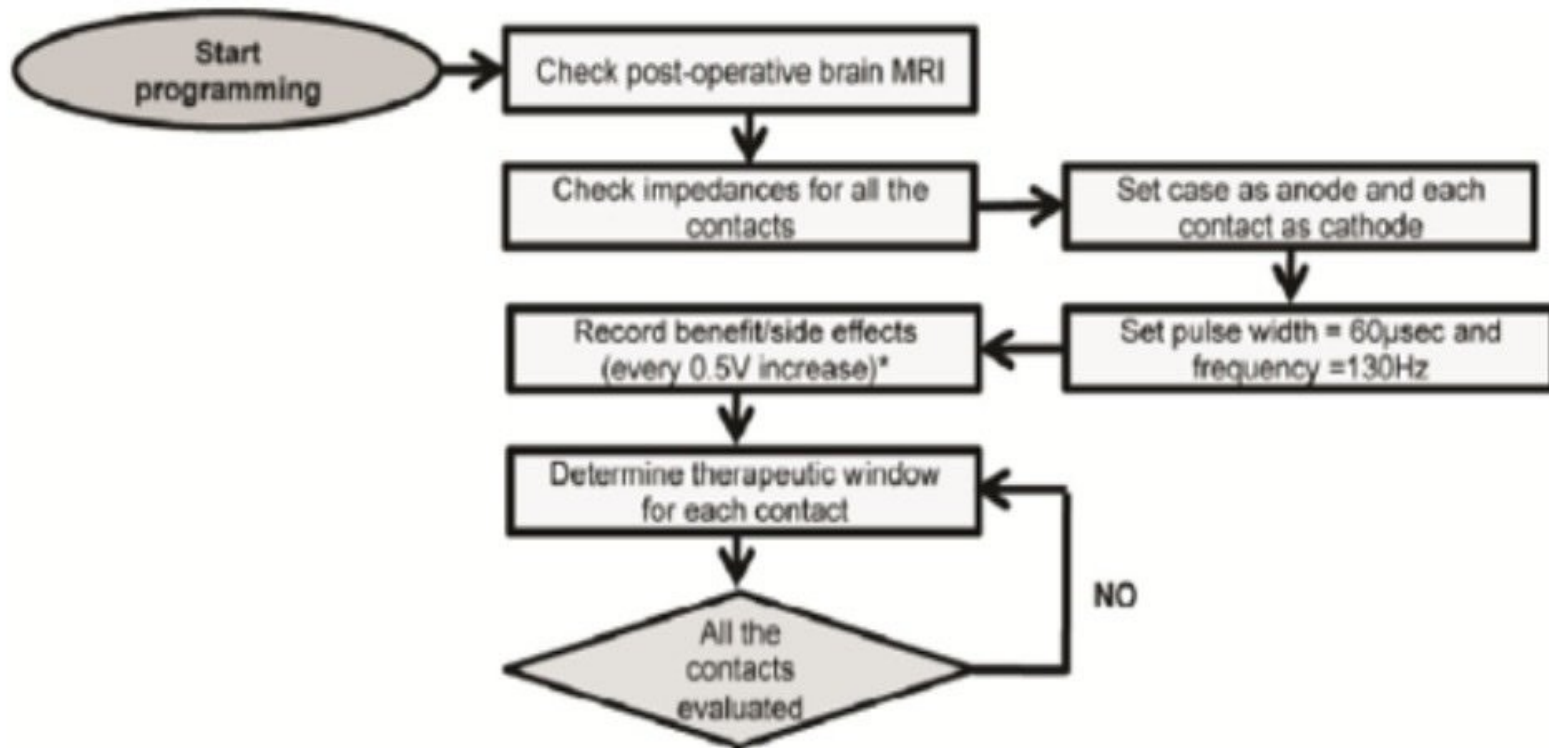
# GOAL OF DBS PROGRAMMING

- ◆ To maximize the clinical effect
  - ◆ To minimize the side effect
- => Find contact with the widest therapeutic window



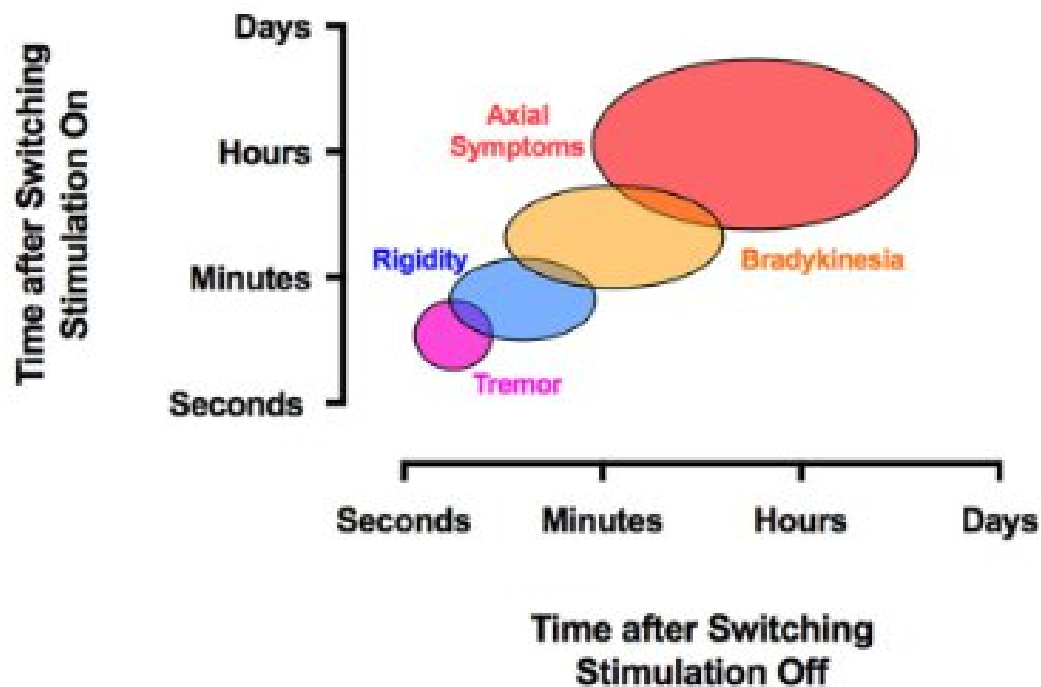


# PROGRAMMING SETUP



# CLINICAL EFFECTS OF PROGRAMMING

The effects of DBS on clinical symptoms are time-dependent

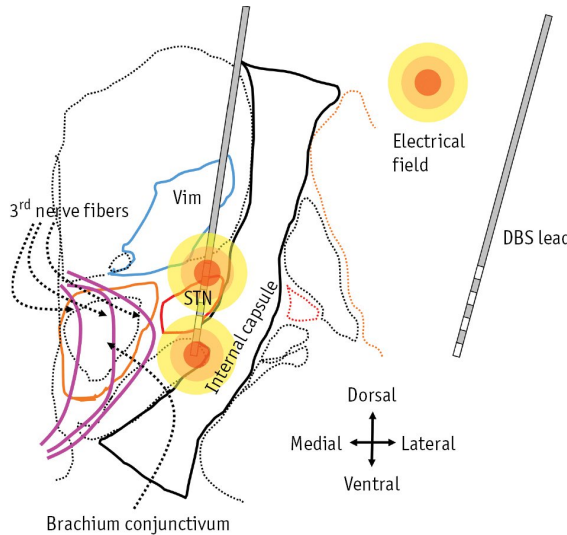




# ADVERSE EFFECT OF PROGRAMMING

## DBS lead too lateral

### A coronal plan



### STN STIMULATION CLINICAL EFFECTS GUIDE

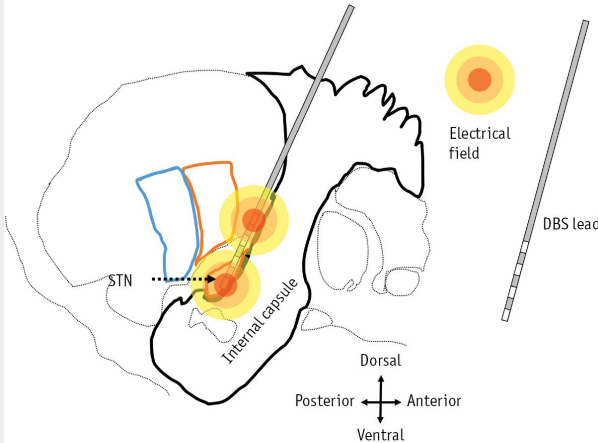
CLINICAL EFFECT NOTED	NEUROANATOMY STIMULATED	ELECTRODE LOCATION IN REFERENCE TO STN	WHICH WAY TO GO ON LEAD
<b>Stimulation-Induced Side Effects</b>			
Akinesia	Substantia Nigra	Ventral	Superior
Apraxia of Eye Lid Opening	CN III Nerve Roots	Medial & Ventral	Superior
Contralateral Gaze Deviation	Internal Capsule	Lateral and Anterior	Inferior
Depression	Limbic STN	Ventromedial Subthalamic Nucleus	Superior
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Tonic Muscle Contractions	Internal Capsule	Lateral and Anterior	Inferior
Warm Sensations	Red Nucleus	Posteromedial	Superior



# ADVERSE EFFECT OF PROGRAMMING

## DBS lead too anterior

### A sagittal plan



- ◆ **Intervention:**
  - Use bipolar stimulation
  - Directional lead with medial segment

### STN STIMULATION CLINICAL EFFECTS GUIDE

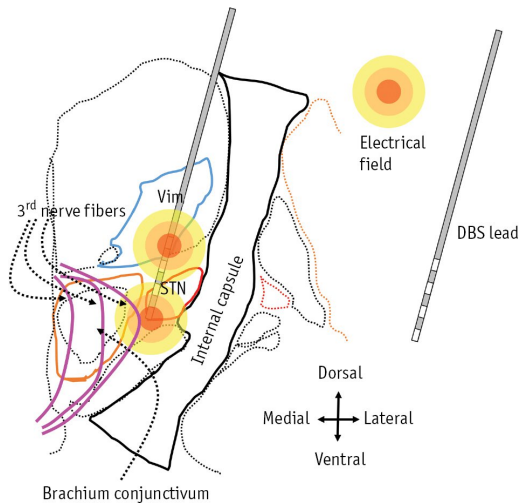
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# ADVERSE EFFECT OF PROGRAMMING

## DBS lead too medial

### A coronal plan



### STN STIMULATION CLINICAL EFFECTS GUIDE

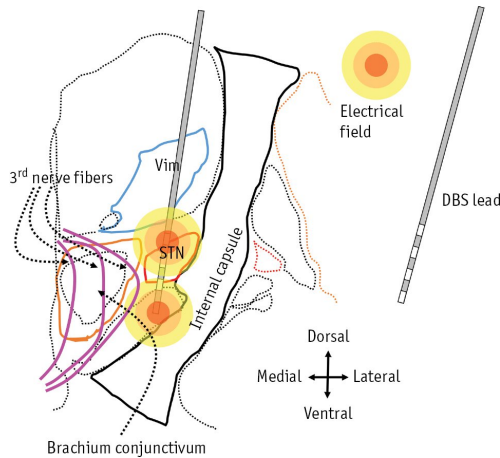
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Warm Sensations	Red Nucleus	Posteromedial	Superior



# ADVERSE EFFECT OF PROGRAMMING

## DBS lead too ventral

### A coronal plan



### STN STIMULATION CLINICAL EFFECTS GUIDE

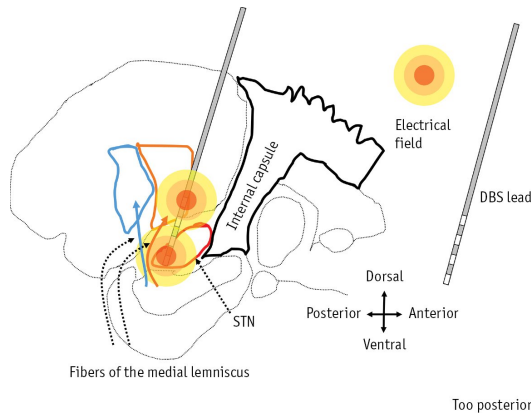
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Tonic Muscle Contractions	Internal Capsule	Lateral and Anterior	Inferior
Warm Sensations	Red Nucleus	Posteromedial	Superior



# ADVERSE EFFECT OF PROGRAMMING

## DBS lead too posterior

### A saggital plan



### STN STIMULATION CLINICAL EFFECTS GUIDE

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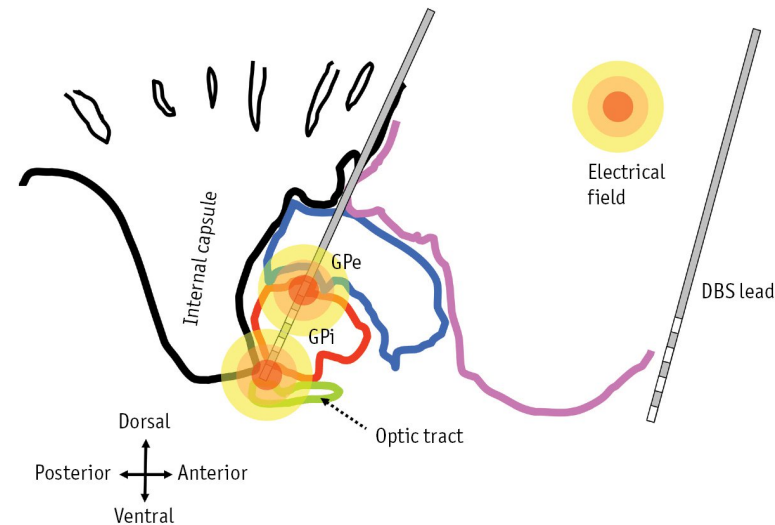
# ADVERSE EFFECT OF PROGRAMMING

## GPI

### DBS lead too ventral:

- ◆ Electrical stimulation spreads to the fibers of the optic tract: visual disturbances as phosphenes
- ◆ Intervention: use more dorsal contacts

### A sagittal plan



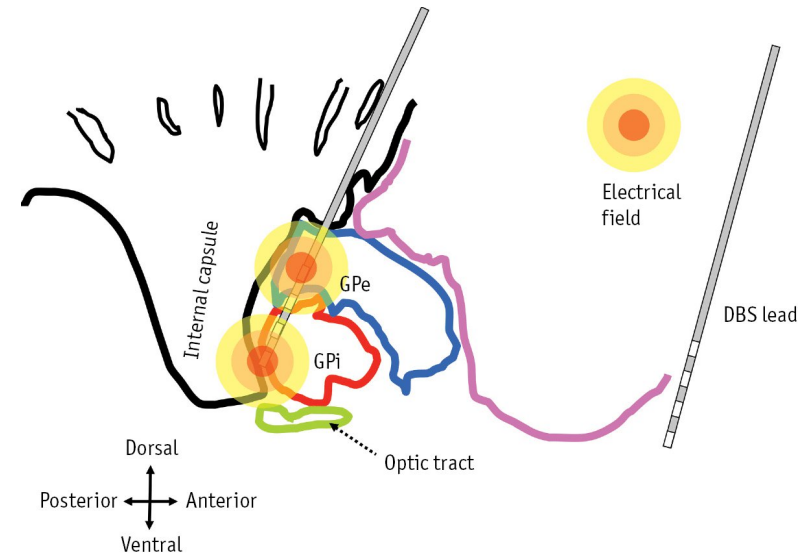
# ADVERSE EFFECT OF PROGRAMMING

## GPi

### DBS lead too medial or posterior:

- ◆ Electrical stimulation activate internal capsule: cause spasm
- ◆ Intervention: use more dorsal contacts, or directional lead

### A sagittal plan



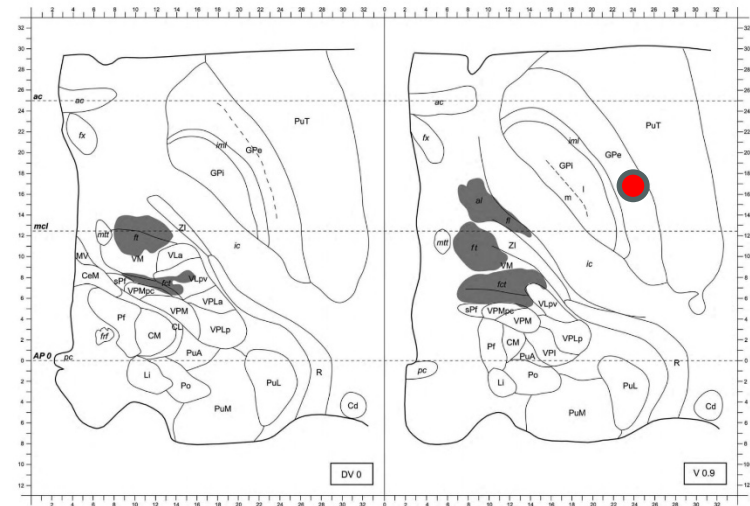
# ADVERSE EFFECT OF PROGRAMMING

## GPI

**DBS lead too lateral:**

- ◆ Electrical stimulation in Gpe: no benefit, no side effect -> spend more energy

**A axial view**



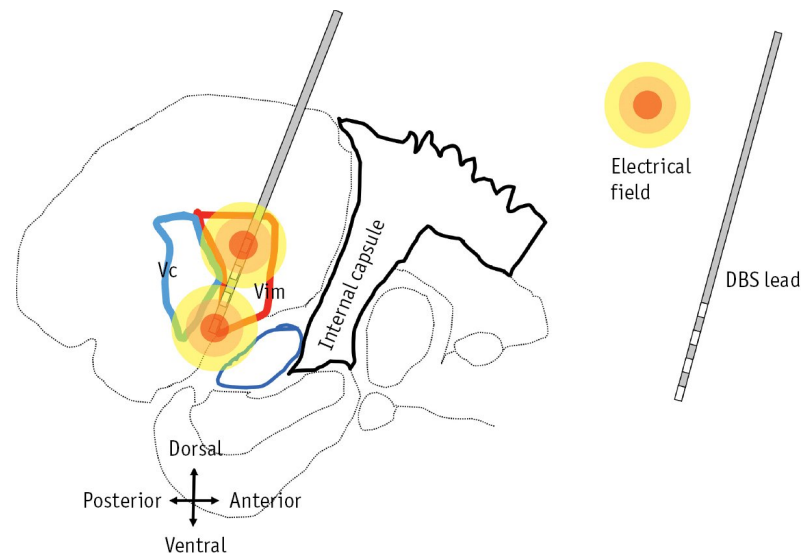
# ADVERSE EFFECT OF PROGRAMMING

## VIM

### DBS lead too posterior:

- ◆ Electrical stimulation spreads to the ventrocaudal nucleus of the thalamus (Vc): paresthesias.
- ◆ Intervention: use more dorsal contacts or bipolar configurations or interleaved stimulation with the smaller stimulation current or directional lead with anterior segment

### A sagittal plan





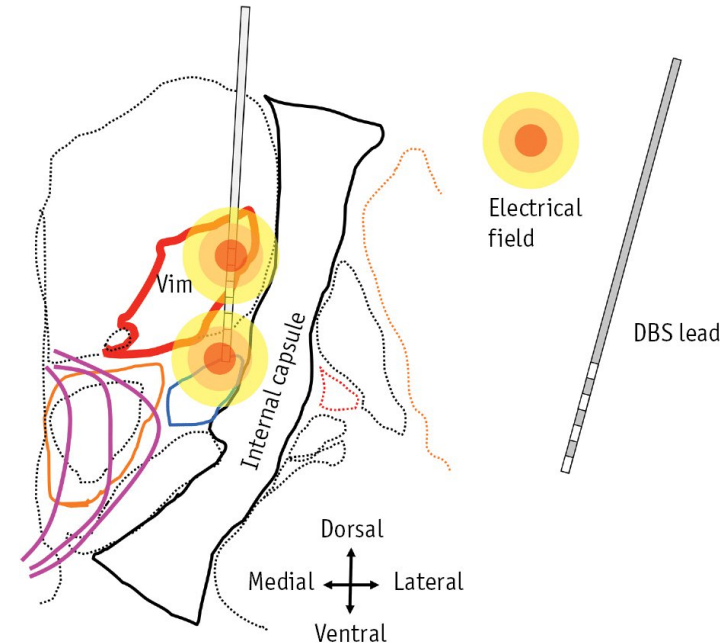
# ADVERSE EFFECT OF PROGRAMMING

## VIM

### DBS lead too lateral:

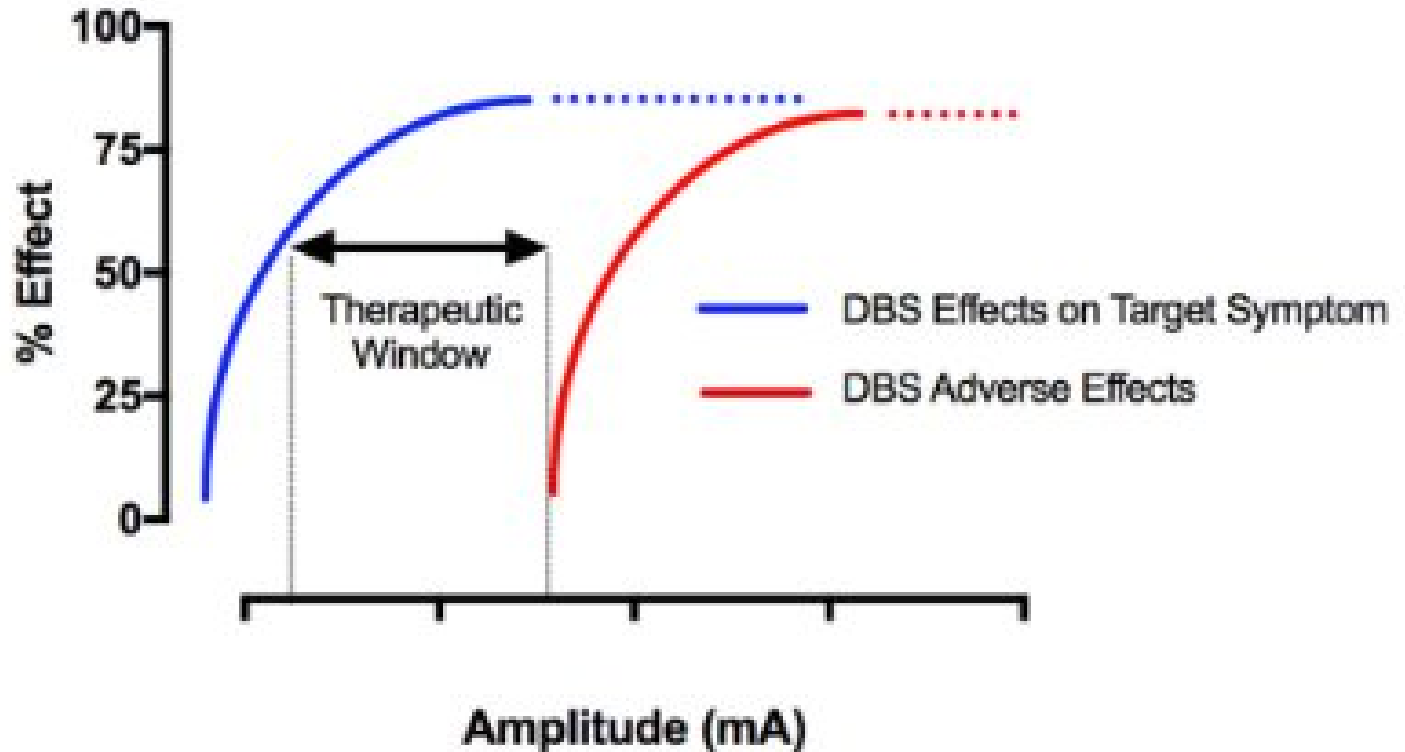
- ◆ Electrical stimulation spreads to the internal capsule: muscle contractions
- ◆ Intervention: use bipolar configurations or directional lead with medial segments

### A coronal plan



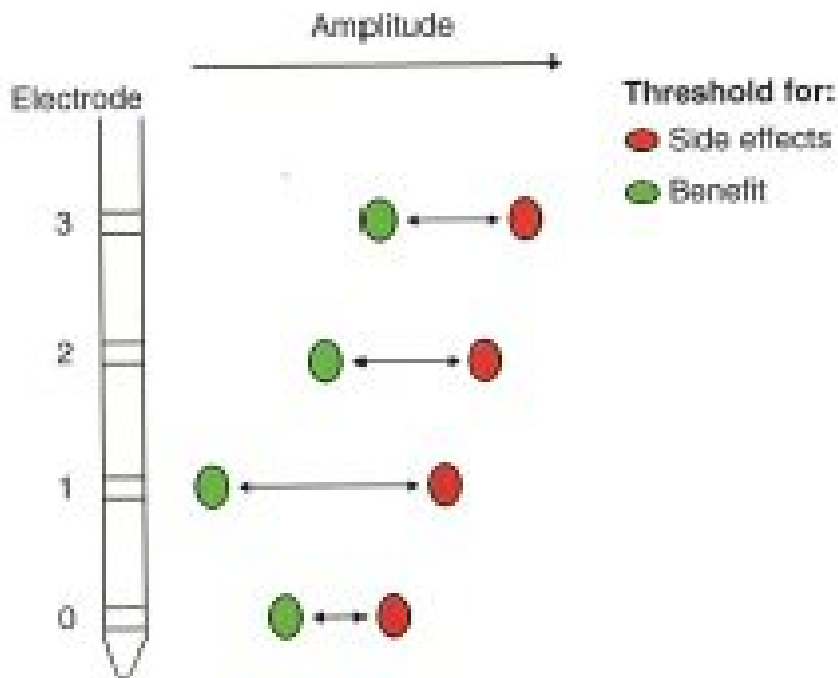


# THERAPEUTIC WINDOW



# THERAPEUTIC WINDOW

Identify “therapeutic window” or  
“Sweet spot”:

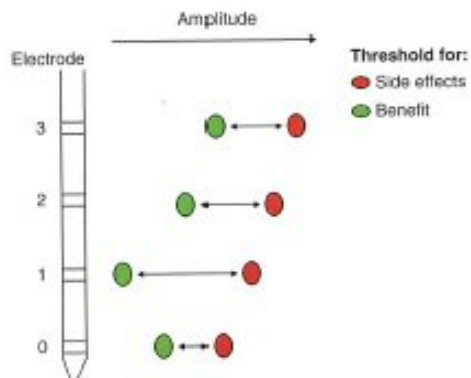


# INITIAL DBS PROGRAMMING

## 1. Predominant Phenotype:

- Tremor
- Akinetic-rigid
- Axial: FOG, balance
- Dyskinesia

## 2. Therapeutic window



# TREMOR-DOMINANT PD: PROGRAMMING STRATEGY

1. **Amplitude Tremor:** is highly amplitude-responsive, Often requires higher stimulation levels
2. **Frequency:** 130–160 Hz. May be increased in tremor-resistant cases
3. **Contact selection:** Prefer dorsal STN/Zona incerta may provide additional tremor control
4. **Managing side effects:** Dysarthria / capsular effects → Use directional steering → Reduce pulse width (PW)

# AKINETIC-RIGID PD: PROGRAMMING STRATEGY

## 1. Contact selection:

- Target sensorimotor STN (posterolateral region)
- Clinical response is highly location-dependent

## 2. Amplitude: Moderate increase improves bradykinesia and rigidity

## 3. Frequency: ~130 Hz (Limited additional benefit from higher frequencies)

## 4. Fine-tuning:

- Adjust pulse width (PW) to optimize therapeutic window
- Consider directional stimulation if side effects occur

# AXIAL SYMPTOMS: PROGRAMMING STRATEGY

## 1. Axial symptoms:

- Are often less responsive to conventional DBS
- May worsen with overstimulation

## 2. Amplitude:

- Avoid excessive stimulation
- High amplitude may impair gait and balance

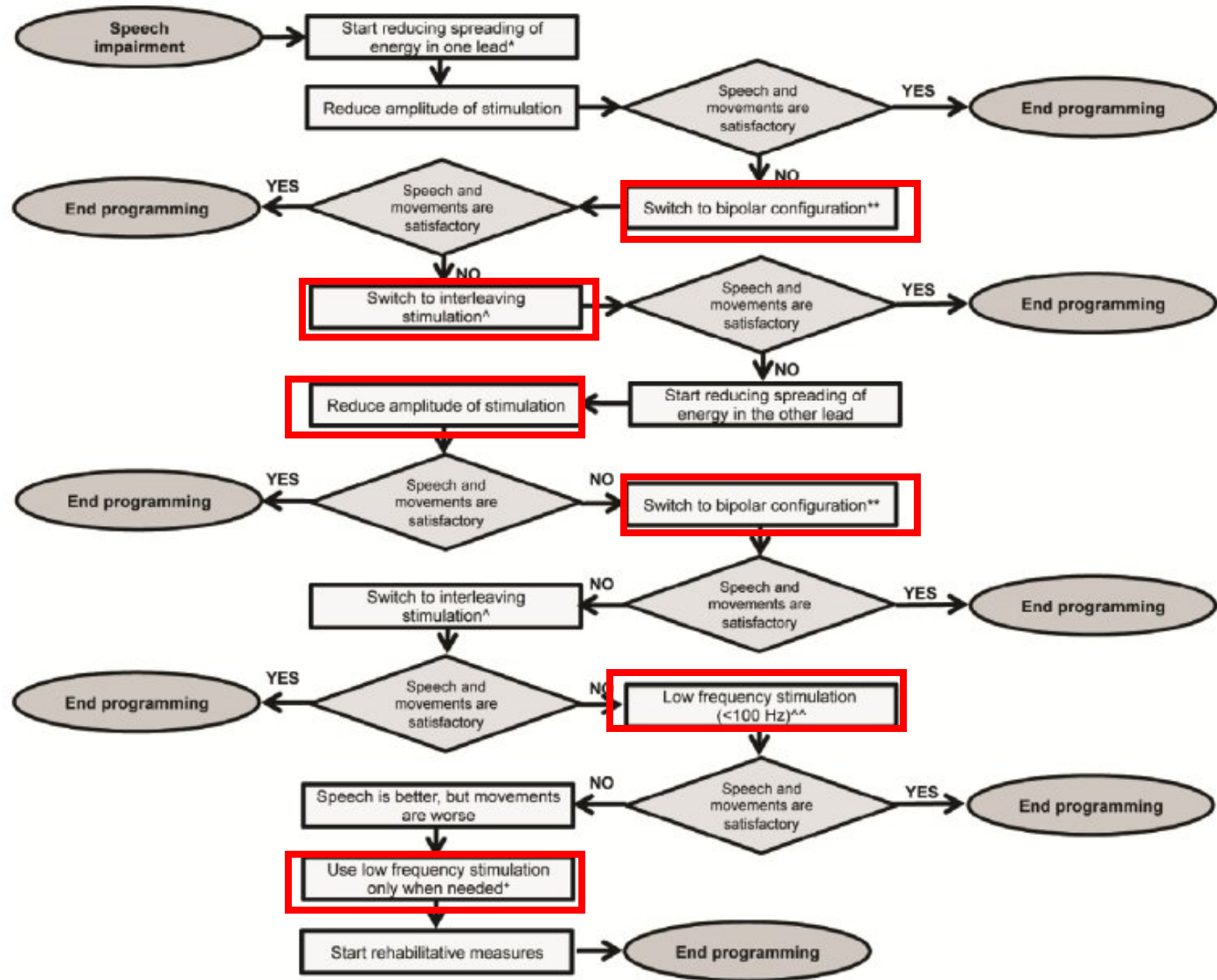
## 3. Frequency:

- Consider low-frequency stimulation (60–80 Hz)
- May improve freezing of gait in selected patients

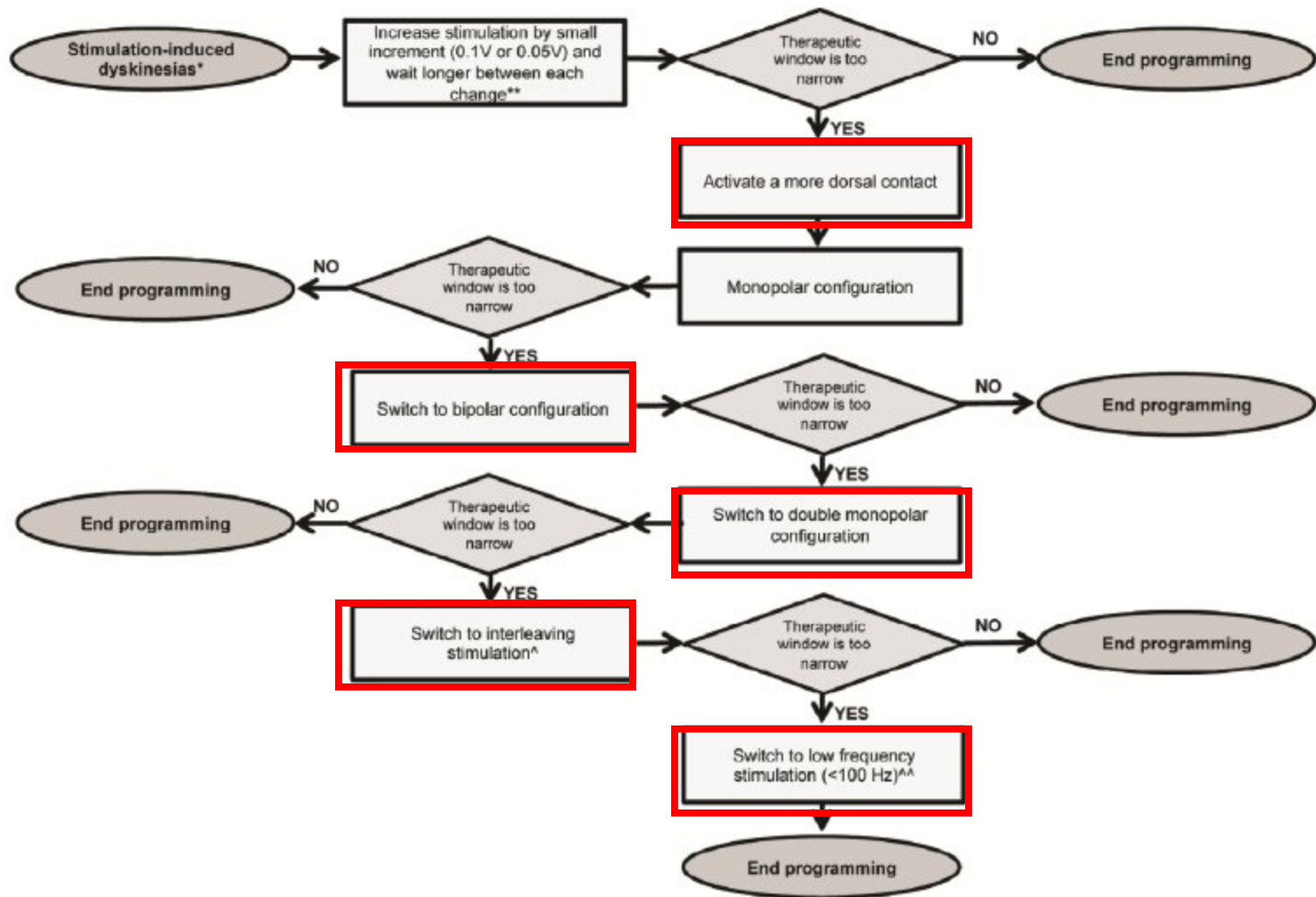
## 4. Contact selection:

- Consider dorsal STN / zona incerta region
- Effects are variable and patient-specific

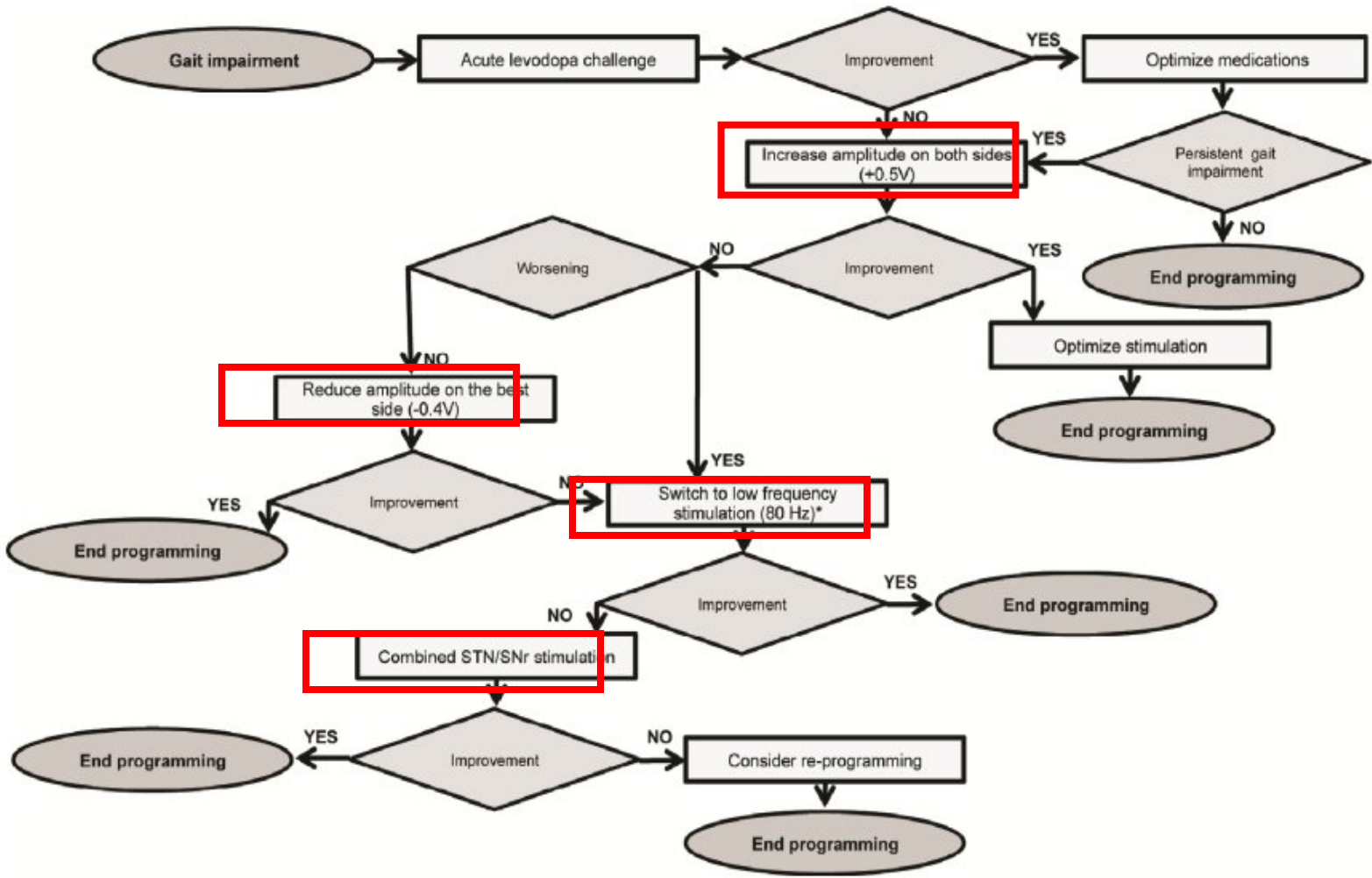
# PROGRAMMING ALGORITHM FOR SPEECH IMPAIRMENT



# PROGRAMMING ALGORITHM FOR STIMULATION INDUCED DYSKINESIA



# PROGRAMMING ALGORITHM FOR GAIT IMPAIRMENT



# LIMITATIONS OF CLASSIC DBS PROGRAMMING

- Consuming the time and dependent on clinician experience
- Failure to identify the “sweet spot”: Suboptimal balance between benefit and side effects
- Limited performance in complex phenotypes: Axial symptoms (FOG, balance ) and dyskinesia



# RECENT ADVANCES IN DBS PROGRAMMING

- Imaging-guided programming
- LFP-guided programming
- Adaptive / closed-loop DBS



# TAKE-HOME MESSAGES

- After operation, DBS programming determines long-term clinical outcomes
- Amplitude, pulse width, frequency, and contact selection are the core parameters that shape therapeutic and adverse effects
- Understanding classic programming principles is essential before applying advanced or adaptive strategies

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# THANK YOU FOR YOUR ATTENTION!

