The following conclusions might be helpful for physicians and patients in adjusting parameters of DBS treatment:

- Increases in pulse width to 0.20 ms or above in DBS also improves a PD patient’s thalamic fidelity.
- It is suggested that further research should focus on quantifying specific boundaries of minimum and maximum amplitude and pulse widths.

**Discussion/Conclusions**

- The following conclusions might be helpful for physicians and patients in adjusting parameters of DBS treatment:
  - Increases in amplitude to 200 μA/cm² or above in DBS create a more robust response in the PD patient’s thalamic fidelity.
  - Increases in pulse width to 0.20 ms or above in DBS also improves a PD patient’s thalamic fidelity.
- It was found that the BG model is limited by programming and time constraints:
  - The model was not employed to investigate the consequences of overstimulation and excitotoxicity with DBS.
  - The accuracy of information transmission through the thalamus (thalamic fidelity) was tested through monitoring thalamic responses to electric stimuli from the sensorimotor cortex (SMC) and recording an error index of inaccurate spikes, such as misses or bursts.
  - In BG models with PD, monophasic DBS pulses were applied intracellularly to STN at various amplitudes ranging from 50 to 500 μA/cm² at a control pulse width of 0.3 ms. This model was not used to test for simultaneous changes in amplitude and pulse width—it was only focused on one variable at a time while keeping the other variable constant.
- Several aspects of DBS remain to be optimized, largely due to the lack of understanding of the mechanisms used in DBS.
- Adjusting parameters for DBS is currently time consuming and tedious, presenting a burden for clinicians, and causing discomfort and frustration for patients.

**Methods**

- To vary DBS amplitude and pulse width, we expanded the number of parameters in a basal ganglia-thalamic network model (BG model) developed by So, Kent, and Grill (So et al. 2011) which simulated the relative contributions of activation and silencing of local cells (LCs) and fibers of passage (FOPs).
- The accuracy of information transmission through the thalamus (thalamic fidelity) was tested through monitoring thalamic responses to electric stimuli from the sensorimotor cortex (SMC) and recording an error index of inaccurate spikes, such as misses or bursts.

**Introduction**

- Parkinson’s Disease (PD) is a progressive nervous system disease which causes dyskinesias, tremors, and motor symptoms.
- PD is often treated with deep brain stimulation (DBS) of the subthalamic nucleus (STN).
- DBS activates local cells (LCs) in the target nucleus, but also fibers of passage (FOPs) that project to other nuclei but pass close to the target (Mincioovic et al., 2006 and Johnson et al., 2008).
- Several aspects of DBS remain to be optimized, largely due to the lack of understanding of the mechanisms used in DBS.
- To vary DBS amplitude and pulse width, we expanded the number of parameters in a basal ganglia-thalamic network model (BG model) developed by So, Kent, and Grill (So et al. 2011) which simulated the relative contributions of activation and silencing of local cells (LCs) and fibers of passage (FOPs).
- The accuracy of information transmission through the thalamus (thalamic fidelity) was tested through monitoring thalamic responses to electric stimuli from the sensorimotor cortex (SMC) and recording an error index of inaccurate spikes, such as misses or bursts.
- In BG models with PD, monophasic DBS pulses were applied intracellularly to STN at various amplitudes ranging from 50 to 500 μA/cm² at a control pulse width of 0.3 ms. This model was not used to test for simultaneous changes in amplitude and pulse width—it was only focused on one variable at a time while keeping the other variable constant.
- Several aspects of DBS remain to be optimized, largely due to the lack of understanding of the mechanisms used in DBS.
- Adjusting parameters for DBS is currently time consuming and tedious, presenting a burden for clinicians, and causing discomfort and frustration for patients.

**Results**

- Graphs show the effects of varying the amplitude of DBS treatment in the BG model on each region of the network and on thalamic fidelity.
- To vary DBS amplitude and pulse width, we expanded the number of parameters in a basal ganglia-thalamic network model (BG model) developed by So, Kent, and Grill (So et al. 2011) which simulated the relative contributions of activation and silencing of local cells (LCs) and fibers of passage (FOPs).
- The accuracy of information transmission through the thalamus (thalamic fidelity) was tested through monitoring thalamic responses to electric stimuli from the sensorimotor cortex (SMC) and recording an error index of inaccurate spikes, such as misses or bursts.
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**References**