Pulse width

The pulse width is a measure of the elapsed time between the leading and trailing edges of a single pulse of energy.

A meta-analysis investigated the effectiveness of short pulse width DBS (spDBS) versus conventional DBS (cDBS) in patients with Parkinson's disease.

Four databases (PubMed, Cochrane, Web of Science, and Embase) were independently searched until October 2021 by two reviewers. They utilized the following scales and items: therapeutic windows (TW), efficacy threshold, side effect threshold, Movement Disorder Society-Sponsored Revision Unified Parkinson's Disease Rating Scale (MDS-UPDRS) part III off-medication score, Speech Intelligence Test (SIT), and Freezing of Gait Questionnaire (FOG-Q).

The analysis included seven studies with a total of 87 patients. The results indicated that spDBS significantly widened the therapeutic windows (0.99, 95% CI = 0.61 to 1.38) while increasing the threshold amplitudes of side effects (2.25, 95% CI = 1.69 to 2.81) and threshold amplitudes of effects (1.60, 95% CI = 0.84 to 2.36). There was no statistically significant difference in UPDRS part III, SIT, and FOG-Q scores between spDBS and cDBS groups, suggesting that treatment with both cDBS and spDBS may result in similar effects of improved dysarthria and gait disorders.

Compared with cDBS, spDBS is effective in expanding therapeutic windows (TW). Both types of deep brain stimulation resulted in improved gait disorders and speech intelligibility [1)]

Previous acute challenge studies suggested that short pulse widths might increase the therapeutic window of Subthalamic deep brain stimulation for Parkinson's disease while maintaining motor symptom control with a decrease in energy consumption. However, only little is known about the effect of short pulse width stimulation beyond the setting of an acute challenge.

Objective: To compare 4 weeks of STN-DBS with conventional pulse width stimulation (60µs) to 4 weeks of STN-DBS with short pulse width stimulation (30µs) regarding motor symptom control.

Methods: This study was a monocentric, double-blinded, randomized crossover non-inferiority trial investigating whether short pulse width stimulation with 30µs maintains equal motor control as conventional 60µs stimulation over a period of 4 weeks (German Clinical Trials Register No. DRKS00017528). The primary outcome was the difference in motor symptom control as assessed by a motor diary. Secondary outcomes included energy consumption measures, non-motor effects, side effects, and quality of life.

Results: Due to a high dropout rate, the calculated sample size of 27 patients was not met and 24 patients with Parkinson's disease and STN-DBS were included in the final analysis. However, there were no differences in any investigated outcome parameter between the two treatment conditions.

Conclusion: This study demonstrates that short pulse width settings (30µs) provide non-inferior motor symptom control as conventional (60µs) stimulation without significant differences in energy consumption. Future studies are warranted to evaluate the potential benefit of short pulse width

settings in patients with pronounced dyskinesia [2].

1)
Zou X, Shi Y, Wu X, Ye Q, Lin F, Cai G. Efficacy of short pulse and conventional deep brain stimulation in Parkinson's disease: a systematic review and meta-analysis. Neurol Sci. 2022 Nov 16. doi: 10.1007/s10072-022-06484-z. Epub ahead of print. PMID: 36383263.
2)
Petry-Schmelzer JN, Schwarz LM, Jergas H, Reker P, Steffen JK, Dafsari HS, Baldermann JC, Fink GR, Visser-Vandewalle V, Dembek TA, Barbe MT. A Randomized, Double-Blinded Crossover Trial of Short Versus Conventional Pulse Width Subthalamic Deep Brain Stimulation in Parkinson's Disease. J Parkinsons Dis. 2022 Apr 28. doi: 10.3233/JPD-213119. Epub ahead of print. PMID: 35491797.