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Imaging-guided or clinical programming alone in directional DBS: which is better?

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Introduction: Deep brain stimulation (DBS) is a well-established surgical procedure for treatment of motor complications in advanced Parkinson's disease (PD). It is aimed at two main targets; the subthalamic nucleus (STN) and internal globus pallidus (GPi). The GUIDE™ XT is a software which reconstructs and simulates the leads' position, using computerized tomography scan on a 3D anatomical map, helping clinicians to visualize the stimulated field in order to optimize and personalize DBS parameters for each patient.

Objective: To investigate if imaging-guided programming provides an advantage in modulating DBS parameters compared with clinical programming alone.

Methods: We evaluated a cohort of 56 PD patients who underwent DBS surgery with directional leads (44 STN and 12 GPi, 38 Male and 18 Female, mean age 62 years) from 2017 to 2022. Of these, 27 were re-evaluated in OFF medication after clinical (T1) and imaging-guided programming (T2). Time span between T1 and T2 was six months. Clinical status was evaluated through the Unified Parkinson's Disease Rating Scale (UPDRS) part III and IV. We compared the two groups using the Wilcoxon matched-pairs signed rank test. A p-value of less than 0.05 was considered significant.

Results: Imaging-guided programming produced a significant clinical improvement as measured with the UPDRS scale; mean UPDRS part III scores decreased significantly between T1 and T2 (T1= 17,3±10,6; T2 15,6 ± 10,7 p=0,008). Similarly, we observed a meaningful effect on motor fluctuations measured with UPDRS part IV (T1=3,26 ±3,53; T2 =1,92± 2,2; p=0,003). There was no relevant difference of levodopa equivalent daily dose (LEDD) between T1 and T2.

Conclusion: Imaging-guided DBS programming could provide an important tool to achieve optimized and personalized stimulation and improve clinical outcomes. Prospective randomized trials are needed to better understand if DBS imaging-guided is more suitable than clinical programming alone.