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Effect of subthalamic nucleus deep brain stimulation on driving in Parkinson's disease

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ABSTRACT: To examine the influence of subthalamic nucleus (STN) deep brain stimulation (DBS) on driving in patients with Parkinson disease (PD). Methods: Using a driving simulator setup proven to reflect on-road driving, 2 main analyses were performed: 1) comparison of driving performance among 23 patients with deep brain surgery (DBS patients), 21 patients without surgery (no-DBS patients), and 21 controls; and 2) analysis of the effect of stimulation vs levodopa on driving performance. To this end, 3 tests were run in the medicated DBS patient cohort, with 3 different conditions: "stimulation on" (STIM) (equated to daily treatment), "stimulation off" (OFF), and "stimulation off/levodopa" (LD) (dosage aimed at maintaining motor status). Differences in driving times and errors among conditions were analyzed. Results: Age and cognitive deficits influenced driving performance negatively. The no-DBS patient group performed worse in driving time and driving errors than controls. DBS patients drove slower than controls and no-DBS patients. Driving safety was comparable to controls but higher than in no-DBS patients. Within the DBS patient group, driving was more accurate with STIM than with LD, although motor effects did not differ. Driving with STIM, but not with LD, was superior to driving in the OFF condition. Conclusion: DBS of the STN seems to have a beneficial effect on driving ability in patients with PD, potentially because of nonmotor driving-relevant aspects. Our data suggest that driving permission for DBS-treated patients with PD should not be handled more restrictively than permissions for patients with PD in general.

STATEMENT: *"We believe that our results provide a high clinical impact. Patients with Parkinson's disease (PD) who had undergone deep brain stimulation (DBS) operation usually continue driving a car but up until now, we were unaware how DBS would affect driving ability. On the one hand, it might enhance driving by improving the motor problems, but on the other hand, it might hamper driving because it potentially causes a decline in executive cognitive skills. We found that DBS has no negative but rather a beneficial effect on driving in PD patients. So regaining a better driving ability in PD might be one aspect of improved quality of life with DBS in comparison to medical treatment alone. The paper is a result of good interdisciplinary teamwork of clinicians and scientists at the UKE. The paper was highlighted in the section "In Focus" of "Neurology" and it has been selected for the American Academy of Neurology's (AAN) press release program."*

BACKGROUND: This work was performed in the interdisciplinary DBS group at the UKE, neurologically headed by Carsten Buhmann. It was part of the doctoral thesis of Lea Maintz and Jonas Hierling. The work was performed in close collaboration with the Departments of Neurology, Neurosurgery, Neurophysiology & Pathophysiology and Medical Biometry & Epidemiology. Funding was provided by the Georg & Jürgen Rickertsen Stiftung Hamburg. Biology at the Leibniz Institute, Halle. Funding was mainly provided by the DFG.