

# Correlation between laser Doppler measurements and anatomy during deep brain stimulation surgery

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## Introduction

In Deep Brain Stimulation (DBS) the safe, accurate and precise electrode implantation is essential. We have previously presented an optical technique for intra-operative measurements during DBS implantation. The aim of the present study was to establish the link between anatomy and total light intensity (TLI, the greyness of the tissue) and microvascular perfusion recordings.

## Methods

Twelve patients (6 subthalamic nucleus STN, 6 ventral intermediate nucleus Vim) referred for unilateral or bilateral DBS-implantation for the treatment of essential tremor or Parkinson's disease were included in the study. Stereotactic CT imaging was used for planning of the trajectories and targets (n=22). Measurement of the TLI and the microvascular perfusion were performed in mm-steps along the trajectory. TLI and perfusion data were post-processed to "optical trajectories" ranging from the cortex towards the target. These were compared with anatomy along the final trajectories by the use of a brain atlas and Surgiplan.

## Results

Post-processing of the TLI signal showed a clear relationship with anatomy. Characteristic median curves were determined. The curve normally started with low values for STN and Vim patients when in cortex. When the probe entered white matter the TLI increased and stayed at this level until it passed in the vicinity to putamen, caudate nucleus or ventricle. A statistical significant difference ( $p < 0.05$ ) could be shown between white matter and putamen and between white matter and the target area. Concerning microvascular perfusion, high values were often seen in the cortex and low ones in white matter (significant statistical difference:  $p < 0.05$ ). In one case a small bleeding was suspected during surgery with the optical technique. This was confirmed with post-operative CT.

## Conclusion

In summary the optical technique show promising results and typical trajectories were defined towards the STN and Vim, but further evaluation is necessary in order to refine the "optical bar codes" towards specific DBS-targets.