# Postoperative Deep Brain Stimulation (DBS) impedance variability in Parkinson's disease (PD) patients implanted with the Boston Scientific Vercise system

François Alesch MD; Roshini Jain; Lilly Chen; Thomas Brucke; Fernando Seijo; Esther Suarez San Martin; Claire Haegelen; Marc Verin; Michael T Barbe; M Maarouf; Steven Gill FRCS, MS; Alan Whone MBChB, MRCS, PhD; Domenico Servello; Mauro Porta; Lars Timmermann Click To Add Logo

#### Introduction

Most Deep Brain Stimulation (DBS) systems deliver stimulation using voltage-controlled systems where the delivered current is dependent on impedances. Modeling shows that an impedance change of 450 ohm resulted in a 50% reduction in the volume of tissue activated (Butson, 2006). Lempka 2010 proposed that instability in impedances could be partially responsible for the frequent need to reprogram stimulators in DBS patients postoperatively. A currentcontrolled Deep Brain Stimulation system is expected to better control stimulation in the face of changing impedances (Ranck, 1981; Mortimer, 1981). However, data on long-term impedance variability in human Deep Brain Stimulation patients is limited, and within-patient impedance variability has been proposed to be minimal (Sillay, 2010).

In this report, impedance variability in 40 subjects with bilateral DBS over a 52 week period is presented.

## Methods

40 patients with idiopathic Parkinson's disease (PD) were implanted bilaterally with Boston Scientific's current-controlled VerciseTM DBS system in the subthalamic nucleus (STN).

# Results

An overall trend of large changes in impedances was observed in these subjects over the entire period evaluated. A high degree of interpatient variability was observed, with impedances ranging from 574-1512 ohms at activation (n=33, mean=844.8±233, median=778), 919-1583 ohms at 12 weeks (n=28, mean=1182±157, median=1152), 907-1626 ohms at 21 weeks (n=18, mean=1178±186, median=1168), 809-1488 ohms at 26 weeks (n=26, mean=1164±156, median=1158), and 746-1488 ohms at 52 weeks (n=20, mean=1215±202, median=1261).

## Conclusions

Impedances in Deep Brain Stimulation patients vary between and within each patients. This variability over time is similar to that previously reported in animal data. The variability might account for fluctuating effects in voltage controlled DBS systems.

# Learning Objectives

By the conclusion of this session, participants should be able to 1. discuss the changes in impedances following DBS

#### References

1. Butson et al., 2006: Sources and effects of electrode impedance during deep brain stimulation.

2. Lempka 2010: Current-controlled deep brain stimulation reduces in vivo voltage fluctuations observed during voltage-controlled stimulation.

3. Sillay 2010: Long-term measurement of therapeutic electrode impedance in deep brain stimulation.