BACKGROUND

Gait impairment, including freezing (FOG), is frequent in Parkinson’s disease (PD) and responds poorly to classical pharmacological and surgical treatments. Freezing can also be seen for speech and since FOG may be improved by pedunculopontine nucleus (PPN) area stimulation, it is of great interest to examine the PPN stimulation influence on speech.

The PPN is known to modulate locomotor activity. Its dysfunction in the context of PD, e.g., may be the origin of gait and postural impairments. This concept could be extended on the one hand to other movement disorders.

OBJECTIVE

To evaluate the effect of the PPN area stimulation on temporal speech parameters in PD

PATIENTS AND METHODS

PATIENTS AND SUBJECTS

7 patients with PD

SPEECH PRODUCTION RECORDINGS

Carried out in addition to other clinical and gait evaluations (Ferraye et al., 2009, Brain), before and after surgery (5 times during one-year follow-up).

Performed with a digital voice recorder (Microtrack, M-Audio) connected with a head-mounted microphone (AKG4420)

Analysis was performed using the Phonedit environment (Laboratoire Parole et Langage, Aix-en-Provence, France)

STATISTICAL ANALYSIS

A linear mixed model was used (R software) for group analyses with patient as a random term, and treatment nature (L-dopa, STN stimulation, PPN stimulation) and state (off, on) as fixed effects.

RESULTS

No effect of PPN stimulation, nor any interaction between L-dopa and PPN stimulation treatments (p=0.3; N=231 measures), when comparing postoperative data vs. on PPN stimulation (on STN stimulation, off/on dopa). No modification of PPN stimulation effects from the first to the last postoperative evaluation (p=0.3; N=126).

Significant L-dopa deleterious effect (p<0.001; N=231), reducing the MPT up to 23% following dopaminergic administration (1). Comparison between preoperative and postoperative (last evaluation) data showed a negative synergistic effect of treatments: worst MPT were found on dopa/STN stimulation/PPN stimulation (p<0.001; N=225) whereas the best situation was off dopa/on STN stimulation/pre-PPN surgery (2).

Similar results were found for the /pataka/ task, either concerning the main effect of PPN stimulation (3) or the comparison between preoperative and postoperative states (4).

CONCLUSION

The deleterious effect of dopa on MPT was more important when associated with STN and PPN stimulations. These results suggest that bilateral PPN stimulation has to be performed in order to obtain beneficial effects on gait and speech in PD patients.

SPEECH OUTPUT TASKS

Three sustained vowel /a/ (/a1/, /a2/ and /a3/) were produced by every patient, in each of the therapeutic conditions. Temporal measurements were performed in order to assess the Maximal Phonation Time (MPT, in seconds) for the three vowels, which have been averaged.

A second speech task consisted in the repetition of the pseudo-word /pataka/ at normal speech rate, during 30 seconds. Temporal measurements were performed in order to assess the breath group durations (bg, in seconds) that have been needed for the completion of the task.