ROLE OF BASAL GANGLIA FOR SPEECH RATE CONTROL: OBSERVATIONS FROM PATHOLOGY

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ABSTRACT — Speech rate was measured by having 29 patients with basal ganglia dysfunction (BDD) read a list of words. The patients showed, when compared with 10 controls: (i) a wide range in the figures for total duration, total word time (TWT), pause time, mean, SD and variation coefficient of pause (VC), (ii) TWT significantly shorter, (iii) Pause VC higher. Intra—
terated. Grewel (4) the duration of employ
usually greater than normal.

and variation coefficient of pause
all patients with a Parkinson's
disease diagnosis
speech may be either fast or slow.

It seems, nevertheless, that not
all patients with a Parkinson's
disease diagnosis demonstrate a
single "typical" speech impairment. According to authors like Canter (1) and Sarno (7) the rate of speech may be either fast or slow. In a previous study one of the au-
thors of this paper found, in a
sample of 81 patients with Parkin-
son's disease, 38 with a rapid speech rate, 5 % with a slow one and the others with a normal rate

(8). When, in place of clinical
data, the effect of a stimulation of the thalamus ventral-lateral nu-
ucleus (in the course of stereotaxic
operation for parkinsonism) is
considered; this was not always identical, both speech arrests and speech acceleration might be ob-
served (5). The purpose of the pre-
sent study was to examine, using measurement of phonation and pause time, whether or not patients with speech disorders related to Par-
kinson's disease were homogeneous. In addition, the same method was used to characterize speech rate in another group of patients with a symptomatology close to that of Parkinson patients, i.e. Progres-
sume Supranuclear Palsy.

1. MATERIAL AND METHODS

1.1. Subjects
3 groups of French speaking male
subjects entered the study: 1/ 22 patients with idiopathic Parkin-
son's disease (PD) who had never
received L-Dopa therapy (or other specific treatment) with an age
range of 50 to 79 (mean = 63) SD = 8 + 18 of the 22 patients belonged to the sample from which a percep-
tive description of speech was re-
ported in a previous paper (8); 2/ 7 patients with typical features of Progressive Supranuclear Palsy (PSP), and especially no effect of L-Dopa, aged between 50 and 72 (mean = 61 years + 4 months, SD = 5 years 1 month), and 3/ 10 controls, ranging age from 54 to 61 (mean = 59, SD = 4).

All subjects were at a cognitive
and educational level which allowed
reading without problem, except of
a motor origin. 1.2. Material:
The subjects were asked to read a
list of words printed in a column
on a sheet. This material was part
of a more extended protocol inclu-
ding sentence reading, words repe-
tition, automatic speech (numbers,
months) and self-formulated speech. Speech was recorded in a sound-proof
room, at the same time as an elec-
troglottogram, using a two-channel tape recorder (REVOX A77).

1.3. Analysis of temporal patterns
Digital conversion of speech sig-
nal was performed at a sampling
rate of 2 KHz Measurements were
made from the integrated acoustic
signal by a single operator (for
all measure) using a mouse to de-
terminie the word limits on the
screen. The time data were stored
and further statistics obtained from the file. Statistical compa-
risons between groups (Student t
-test) were obtained for the fol-
lowing measures; total duration of
the reading of the words list (TD),
total word time (TWT), pause time (PT), ratio TWT/TFD, mean of pausal duration (MPD), standard deviation of pause duration (SPDT), variation coefficient (VC = SDPT/ MPT).
2. RESULTS
2.1. Comparison between Parkinson's
patients and controls

The comparison of the group means
collection showed significantly shorter mean for total phonation
TWT = 2.53; f = 30; p<.05). The only other significant
difference was for VC, i.e., an
on an average, a higher VC in the PD
group compared to controls (VC-t =
-2.46; f = 30; p<.05). There was
actually a great heterogeneity in
the pause duration of a given pa-
tient which was independent of the
pauses duration as a whole (CV cor-
corresponding to the ratio SD/mean).

2.2. Comparison between PSP patients
and controls
The heterogeneity in patients pause
duration for a single subject was
confirmed in this group. When
compared with controls SDFT and VC
were, on the average, greater
(SDFT-t = -3.38 ; f = 16 ; p<.01.
VC-t = -3.84 ; f = 16 ; p<.01).

Total word duration was in control
rather than in controls, but no sig-
ificant difference was shown (note
the PSP group small size). As
noted for PD speech behavior was different among pa-
ients with a higher variance than in
controls. 2.3. Comparison between PD and PSP
patients
No significant differences could be
shown except for a higher SDFT in
PSP than in PD patients (SDFT-t =
-2.60; f = 27; p<.05).

3. DISCUSSION
3.1. The data obtained in speech
rate analysis in 2 groups of pa-
tients with basal ganglia dysfunc-
tion demonstrated a wide range in
all parameter describing speech rate from very slow to very fast.
Such a high variance in a group of
patients is in agreement with data
obtained in studies where self-
formulated speech was judged by
listeners (4, 7, 8). As far as the
total pause duration (TPT) and mean
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In any case, the differences between patients for speech rate needs to be explained. Further research should test the possible relationship between the type of speech impairment and the clinical, biological and neuroanatomical features. Rough significant correlations have been described between the severity of speech impairment and that of other neurological symptoms in PD patients (8).

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3.3. Patients with PSP demonstrated the same intersubject variability as PD patients, and the same, even at a higher level, intrasubject pause variability.

4. CONCLUSION

There is a need for further research taking into consideration speech rate and rhythm characteristics in other modalities such as reading of sentences or paragraphs, repetition of words or sentences, spontaneous speech.

A first practical conclusion may be that any research on control of speech movements, of articulation or of prosody must be performed using either a sufficient number of subjects, or groups of patients defined on precise criteria (especially concerning speech rate and rhythm). A given medical diagnosis does not imply a single speech modification.

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