Evidence for an apparent sensory speech disorder in Parkinson's disease

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SUMMARY Twenty eight patients with Parkinson's disease (average age 63 years, average duration of disease 8 years) and 28 normal elderly controls (average age 70 years) were tested for their ability to appreciate the prosodic aspects of their own and others' speech, and facial expression. Compared with the controls the Parkinsonian subjects performed worse at these tests, though both groups could easily identify neutral statements. The Parkinsonian subjects were unable to produce statements in an angry or questioning form. These seemed to be features of early Parkinson's disease.

Parkinson's disease is usually considered to be a pure disorder of movement, but there is some evidence of subtle receptive disorders, involving especially visual and spatial perception.¹ Abnormality of prosody dominates the disorder of speech, and often gives a false impression of dysarthria. Prosody, as we are using the term, may be defined as the patterned distribution of stress, intonation and other phonatory features in speech. Variations of these prosodic features can much affect the meaning of spoken language. They can be used to introduce affective or emotional tones of voice and subtle connotations of speech, and to vary the emphasis of speech.² Control of prosody may be a function of the right hemisphere.³

In a previous study of speech therapy in Parkinson's disease,⁴ it was strongly suspected that patients with the disease were unable to appreciate the prosodic features of speech in themselves or others. This was particularly the case in respect of features of intonation, and these patients seemed also unable to appreciate those aspects of facial expression and gesture which may contribute to the emotional side of communication. The present study was designed to test this hypothesis.

Methods

Twenty eight patients with Parkinson's disease (18 men and 10 women, mean age 63 years), were studied. All were

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taking several drugs. Twenty six were on levodopa, mostly in combination form; four were taking bromocriptine, seven anticholinergic drugs and seven benzodiazepines. None showed any disorder involving speech, other than Parkinson's disease, or any apparent language deficit, and none was clinically intellectually impaired. All were tested on a simple auditory discrimination test, to eliminate the possibility of a hearing loss affecting speech. The mean duration of Parkinson's disease was 8 years. All were able to read and attend an out-patient clinic.

A control group of 28 elderly people (13 men and 15 women, mean age 70 years), with similar exclusions, were studied; they were relatives of hospital patients or were attending day clubs for the elderly. All subjects were tested on the complete abstracted version of the Shortened Schuell Test,⁵ and on the Colour/Form Sorting Test.⁶

All subjects with Parkinson's disease were tested for prosodic abnormality,⁷ to determine a speech intelligibility rating, following which both subjects and controls were tested as shown:

Test 1. Discrimination of prosodic contrasts

The phrases follow those used in assessing the speech difficulties of the deaf.⁸ Thus in all the examples (except h) responses are made to prosodic rather than to phonemic contrasts.

The phrases were presented in pairs (that is a neutral statement with another example) and the subjects commented on whether these pairs were the same or different.

The following phrases were played on tape:

- (a) I can run (neutral statement).
- (b) I can run (emphatic stress on *run*).
- (c) I can run (emphatic stress on *can*).
- (d) I can run (neutral statement).
- (e) I can run (exaggerated pause between *can* and *run*).
- (f) I can. Run! (double phrase; statement and command).
- (g) I can run? (intonational form of interrogative style of phrase).

Fig 1 Cartoon picture of facial expressions used in test 2.

Fig 2 Picture used for linguistic analysis taken from Shortened Schuell Test.

(h) Can I run? (differing interrogative word order).
The maximum possible score was 8.

Test 2. Matching of Speech and Facial Expression

Patients were asked to describe each of the facial expressions shown in the cartoons in fig 1, and thereafter listened to a taped phrase and selected the most appropriate facial expression to the single taped phrase.
The maximum score was 1.

Test 3. Discrimination of the affective and grammatical functions of prosody

Subjects listened to the following sentences on tape and commented upon the emotional features presented.

- It's me, Alison (nominative function, that is "me" and "Alison" in apposition).
- It's me, Alison (vocative function, that is "me" and "Alison" as different people).
- Don't hurry (sarcasm).
- Don't hurry (caring advice).
- Good morning (officious and abrupt greeting).

- Good morning (pleasant greeting).
 - I scream (the action).*
 - Ice-cream (the confection).*
- *Demonstrates a grammatical function of prosody.
The maximum possible score was 8.

Test 4. Discrimination of the semantic role of prosody

Subjects had to comment on whether the paired phrases in Test 1, had the same or different meanings.
The maximum possible score was 4.

Test 5. Production of Anger

Subjects were asked to read the following sentences in an angry tone of voice:

- I don't want to go.
- That's my pen.
- Go away.

The maximum score was 3.

Test 6. Production of Question Form

The subjects were asked to produce the same phrases as in Test 5, in a questioning or doubtful manner.
The maximum score was 3.

Test 7. Production of Statement Form

Subjects were asked to read the phrases in Test 5, as neutral statements.
The maximum score was 3.

Subjects were presented with the picture from the Shortened Schuell Test⁸ (fig 2) which they described as completely as possible. Their utterances were written down and analysed for:

- the number of utterances produced;⁹
- the number and grammatical function of words used;
- the number of nouns, pronouns, and verbs used, giving a noun + pronoun/verb ratio;
- the number of deviant utterances.¹⁰

Results

Table 1 shows the means and standard deviations of the prosodic abnormality score and of the seven tests conducted. There was a significant difference between the Parkinsonian and control groups on all except tests 1 and 7. The abnormalities were equally common in those with under 6 and over 11 years duration of Parkinson's disease (table 2).

Table 3 shows an analysis of the utterances in the statement describing the picture in fig 2. The Parkinsonian patients showed approximately four times the number of deviant utterances but no higher a noun + pronoun/verb ratio than the controls. The mean number of utterances and the mean number of words used differed little.

Thirteen of the 28 Parkinsonian patients were unable to perform the Colour/Form Sorting Test, as compared with only one of the normal elderly subjects. The Parkinsonian subjects who could not perform the test showed no substantial difference in

Table 1 Mean scores and standard deviations of the prosodic abnormality score and seven tests

	Maximum possible score	Normal elderly	Parkinson's disease	Significance of difference <i>p</i>
Prosodic abnormality score	7	N/A	4.25±1.11	—
Test No. 1	8	7.68±1.06	7.11±1.45	NS
2	1	0.96±0.19	0.64±0.49	<0.005
3	8	7.57±0.57	5.57±1.83	<0.0005
4	4	3.50±0.64	2.21±1.20	<0.05
5	3	3.00±0.00	1.68±1.36	<0.05
6	3	2.80±0.61	0.64±1.06	<0.00005
7	3	3.00±0.0	3.00±0.0	NS

Table 2 Relationship between scores and duration of disease since diagnosis

	Duration of disease since diagnosis in years		
	<6	7-10	>11
Prosodic abnormality score	3.91±0.70	4.50±1.11	4.29±0.76
Test No. 1	7.73±0.47	6.50±2.12	7.00±1.00
2	0.82±0.40	0.80±0.42	0.29±0.50
3	6.18±1.54	5.00±1.63	5.43±2.40
4	2.55±1.21	1.80±0.63	2.29±1.70
5	1.45±1.51	1.90±0.74	0.45±1.30
6	0.90±0.30	1.10±1.29	0.86±1.20
7	3.00±0.0	3.00±0.0	3.00±0.0
No. in Group	11	10	7

No significant difference between groups in any test

Table 3 Linguistic analysis of picture description

	Normal elderly	Parkinson's disease	Significance of difference
Number of utterances	111	102	—
Mean number of words	37.4	44.3	—
Proportion of deviant utterances	9.9±8.1	39.2±4.8	<0.01
Mean No. (per subject) of Nouns+			
pronouns	9.9±3.8	8.7±4.6	NS
Verbs	6.8±2.6	4.8±3.2	NS
Noun+pronoun/verb ratio	1.5±0.4	2.0±1.2	NS

overall performance from those that could (table 4).

Neither group made any errors in the Shortened Schuell Test,⁵ and all performed the auditory discrimination test normally.

Discussion

There is no evidence that either the Parkinsonian subjects or control group, which was on average 7 years older, showed any cognitive impairment. None

Table 4 Parkinson's disease patients unable to perform colour/form sorting test compared with those who could

	Mean scores ± standard deviations	
	Parkinson's disease patients able to perform CFST (n=15)	Parkinson's disease patients unable to perform CFST (n = 13)
Prosodic abnormality score	3.73±0.96	4.77±0.93
Test No. 1	6.93±1.75	6.85±1.77
2	0.60±1.75	0.77±0.44
3	6.13±0.99	4.92±2.36
4	2.40±0.99	2.00±1.41
5	1.93±1.33	1.38±1.39
6	0.80±1.26	0.69±1.03
7	3.00±0.0	3.00±0.0

showed any clinically apparent intellectual impairment, and the total absence of errors in the Shortened Schuell test confirms this. Although this is formally a test of language function, a small number of errors in this test and in each of its subsections may be found in normal old age, and are always frequent in the presence of intellectual impairment.¹¹ The abnormalities of utterance shown in table 3 are entirely different in type from those which are characteristic of normal ageing and, to a much more marked degree, of early dementia.¹² There is thus no evidence of a problem involving general processing mechanisms, or of receptive language difficulty, in the Parkinsonian subjects.

The Colour/Form Sorting Test abnormalities are probably to be interpreted as evidence of undue concreteness, or loss of abstraction⁶ in the thought processes of Parkinson's disease patients. Although the Parkinsonian subjects used an excessive number of deviant utterances in their description of the picture, the absence of a difference in the noun + pronoun/verb ratio goes against this.¹³ Neither provides evidence of intellectual impairment.

The Parkinsonian patients differed from the controls in six of the seven tests of prosody, but were not statistically different in their ability to discriminate prosodic contrast, or in their production of neutral statement forms of the phrases used. The differences between the two groups were greatest in those tests which evaluate the appreciation of intonation and facial expression (tests 2-4). In addition to this apparently sensory problem the Parkinsonian subjects were unable to produce angry or questioning statements, while the controls did so easily and virtually without error. This evidence of a specific failure to react to patterns of intonation and the facial expression of others, or to convey emotionally loaded statements occurs early in the disease and is unrelated to drug treatment (table 2). It suggests a

specific impairment in Parkinson's disease of production and reception of prosody.

Speech is not merely a method of generating words according to meaning or grammatical function and the role of prosody is considerable. Difficulty in discriminating the features of prosody, in producing them and in determining the appropriateness of facial expression may result in social withdrawal through fear of being misunderstood. The existence of such difficulties may have important clinical and therapeutic implications in Parkinson's disease.

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