Speech Abnormalities in Tardive Dyskinesia

Bruce R. Gerratt, PhD; Christopher G. Goetz, MD; Hilda B. Fisher, PhD

• **Twelve outpatients with tardive dyskinesia underwent speech evaluation by trained listeners who analyzed oral reading and vowel production for deviation in multiple speech dimensions. In the six patients with speech abnormalities, temporal organization and voice production dimensions were the most severely deviant and were highly related to the overall intelligibility and bizarre quality of speech. Deviations in articulation were less prominent. Abnormal involuntary movement scale ratings of the trunk in these patients were significantly greater than in the patients without speech impairment, although the lingual-facial-buccal and total body scores were similar between the two groups.**

(*Arch Neurol* 1984;41:273-276)

Orofacial dyskinesia is the most widely recognized clinical feature of tardive dyskinesia (TD). Although speech problems have been previously reported, the speech impairment accompanying TD has not been analyzed in detail, nor have reports provided a systematic description or conceptual integration of the relationship between the speech abnormalities and the total disease process.[1,2] Since speech requires the coordination of the truncal, laryngeal, and orofacial musculature, detailed study of the breakdown in speech production deviations may provide an index for the early detection of this disease.[2,3] Quantified measurement of speech disturbances also might serve as a basis for monitoring changes related to medical therapies and help in the development of rehabilitative techniques to improve speech production in these patients. The present investigation was designed to describe important speech characteristics of patients with TD.

PATIENTS AND METHODS

Twelve patients (three men, nine women) with a mean age of 52.75 years (range, 27 to 72 years) who exhibited no overt symptoms of psychiatric disorders at the time of testing took part in this study. All had a diagnosis of TD made by a neurologist (C. G. G.), and all were currently receiving neuroleptic agents for psychiatric illness. The dose of these drugs had not been altered for at least six weeks prior to the speech evaluations. No patient was receiving concurrent anticholinergic medications, none complained of dry mouth, and none showed evidence of drug-induced parkinsonism.

The intensity and anatomic distribution of dyskinesia were assessed with the abnormal involuntary movement scale (AIMS).[4] Scores were obtained on all patients and calculated for trunk, lingual-facial-buccal musculature, extremities and a summated total body score. Differences were analyzed by the Mann-Whitney *U* test.

Speech testing of each subject included the production of the vowel *ah* for as long, clearly, and steadily as possible and the reading of "The Rainbow Passage."[5] All productions of speech tasks were tape recorded on a high-quality tape system in a sound-treated room at a speaker-to-microphone distance of 20 cm. Forty-five-second samples of these tasks were dubbed to make evaluation tapes. Since one subject could not read the passage, a sample of conversational speech was used in its place. The recorded speech samples were judged by two experienced speech/language pathologists for deviation in the speech dimensions of pitch, loudness, vocal quality, articulation, and timing. Subjects were classified as having a speech impairment if deviations were found in any of these dimensions. There was 100% agreement between the two judges both for those six subjects selected as having an impairment (group 1) and for the six patients judged not to have a speech impairment (group 2).

Detailed speech evaluation in the speech-impaired group of patients included ratings by a group of eight speech pathologists with previous clinical experience in treating dysarthric patients. In preliminary evaluation of the speech samples, 19 of the 32 dimensions used in the Mayo Clinic dysarthria study[6] were found deviant and therefore were selected for rating overall speech quality and three subcategories of speech: voice production, temporal organization, and articulation. Each speech sample was rated on a seven-point, equal-interval scale of severity, with 1 representing normal speech and 7 representing an extremely severe deviation.

The measure of severity of deviation for each dimension was the grand mean for the ratings of all six subjects for that dimension. This score was obtained by averaging the scale values assigned to each subject by all eight judges and then averaging these values. One dimension, prolonged phonemes, had a mean scale value less than 2.0, which was considered too small for further interpretation and therefore was excluded from further analysis. In addition to this individual ranking, each dimension was evaluated for its relative importance to two overall speech assessment dimensions: intelligibility of speech

Accepted for publication April 30, 1983.

From the Department of Communicative Disorders, Northwestern University, Evanston, Ill (Drs Gerratt and Fisher); and the Department of Neurological Sciences, Rush-Presbyterian-St Luke's Medical Center, Chicago (Dr Goetz). Dr Gerratt is now with the Department of Audiology and Speech Pathology, Veterans Administration Medical Center, West Los Angeles and with UCLA.

Read in part at the annual convention of the American Speech-Language-Hearing Association, Atlanta, 1980.

Reprint requests to Department of Neurological Sciences, Rush-Presbyterian-St Luke's Medical Center, 1753 W Congress Pkwy, Chicago, IL 60612 (Dr Goetz).

and bizarreness (the degree to which the overall speech calls attention to itself because of its unusual characteristics), since these two overall dimensions are important parameters of communicative effectiveness. Spearman's rank order correlations were performed on these latter values.

To determine if the speech abnormalities associated with TD are similar in subjects, or if unique clusters of speech deviation occur, the ratings for each subject were analyzed individually and the profiles compared. Standardized z scores were computed for the two overall dimensions (intelligibility and bizarreness) and the 11 dimensions with mean scale values greater than 2.0. Each z score was calculated by subtracting each subject's mean scale value on a dimension from the grand mean for all subjects on that dimension and dividing by the SD.

Intraobserver reliability, using three dimensions randomly selected and rated a second time by each judge, showed a Spearman's correlation of .87. Intersubject reliability measured by Kendall's coefficient of concordance compared the ratings of all eight judges for each dimension. Overall, concordance for 14 dimensions used in analysis was .81. Intersubject reliability for breathy voice, distorted vowels, voice stoppages, monopitch, and monoloudness was below .70 and, hence, data from these dimensions were rejected from further analysis.

Table 1.—Characteristics of Speech-Impaired and Non-Speech-Impaired Patient Groups

	Group 1: Speech-Impaired	Group 2: Non-Speech-Impaired
Sex, M/F	2/4	1/5
Mean age, yr	51.5 (27-72)*	54.0 (30-64)
Duration of tardive dyskinesia, yr	4.33 (2-8)	5.8 (1-10)
Duration of neuroleptic therapy, yr	7.20 (5-10)	8.1 (2.5-9.5)
Mean AIMS† values		
Total	18.2 (6-28)	17.33 (10-19)
Trunk	2.33 (0-4)	0.66 (0-2)‡
Lingual-facial-buccal	11.33 (4-16)	11.0 (7-13)

*Values in parentheses are ranges.
†AIMS indicates abnormal involuntary movement scale.
‡$P < .03$ by Mann-Whitney Student's U test.

Table 2.—Speech Dimensions Ranked by Severity of Deviation From Normal

Rank	Dimension	Mean Score*	Speech Category
1	Short phrases	3.15	Timing
2	Slow rate overall	3.13	Timing
3	Audible inspiration	3.02	Phonatory
4	Strained-strangled voice	2.97	Phonatory
5	Harsh voice	2.83	Phonatory
6	Voice tremor	2.71	Phonatory
7	Variable rate	2.64	Timing
8	Irregular articulatory breakdown	2.60	Articulatory
9	Imprecise consonants	2.58	Articulatory
10	Prolonged intervals	2.56	Timing
11	Excess loudness variation	2.31	Phonatory

*Based on a seven-point scale, with 1 representing normal speech and 7 representing an extreme deviation from normal.

RESULTS

In Table 1, characteristics of the speech-impaired and non-speech-impaired patients with TD are compared. The sexual distribution, age, duration of the disease, and duration of neuroleptic therapy are all similar between the two groups. Although there was no group difference in total AIMS or lingual-facial-buccal scores, truncal involvement in the speech-impaired group was significantly greater than in the patients without speech abnormalities ($P < .03$).

In Table 2, the speech dimensions for speech-impaired patients are ranked by their severity of deviation. The two most severely deviant dimensions, short phrases and slow rate overall, are related to the temporal organization of speech. The next four highest ranking dimensions are related to voice production. The two articulatory dimensions are near the bottom of the ranking, in the eighth and ninth positions.

Table 3 presents the rank order correlations between the individual speech dimensions and the global evaluation of intelligibility and bizarreness of language. Five dimensions were associated with specific breakdown of intelligibility ($P < .05$). All three speech categories are represented: speech-timing deficits (rank 1, 2), speech articulation abnormalities (rank 3, 4), and phonatory irregularities (rank 5). Four dimensions were related ($P < .05$) to the bizarre quality of TD speech, three of which belong to the category of speech timing.

The individual patient z scores for each dimension are graphed in the Figure. In subjects 2 and 4, the phonatory system appeared the most impaired, while articulation and temporal organization were less affected relative to the other subjects. The ratings of intelligibility deficits and bizarreness for both subjects were low, reflecting a similarity in the overall impression of a mild deviation in their speech production quality. Subjects 5 and 6 also had similarities in their speech profiles, with the major category affected being voice production, specifically, strained-strangled voice. Both subjects were near the mean of the group in most dimensions of articulation and temporal organization. They scored similarly with respect to intelligibility and bizarreness, showing a similar moderate degree of dysarthric speech quality.

The profiles of subjects 1 and 3 bear little resemblance to the other subjects in the group. They both received the highest ratings for deviations in intelligibility and bizarreness and were judged as most severely impaired in speech production of all six subjects. Subject 1 had eight of 13 positive z scores and subject 3 had 11 of 13 positive z scores for speech deviation, reflecting the severity of their defective use of speech.

COMMENT

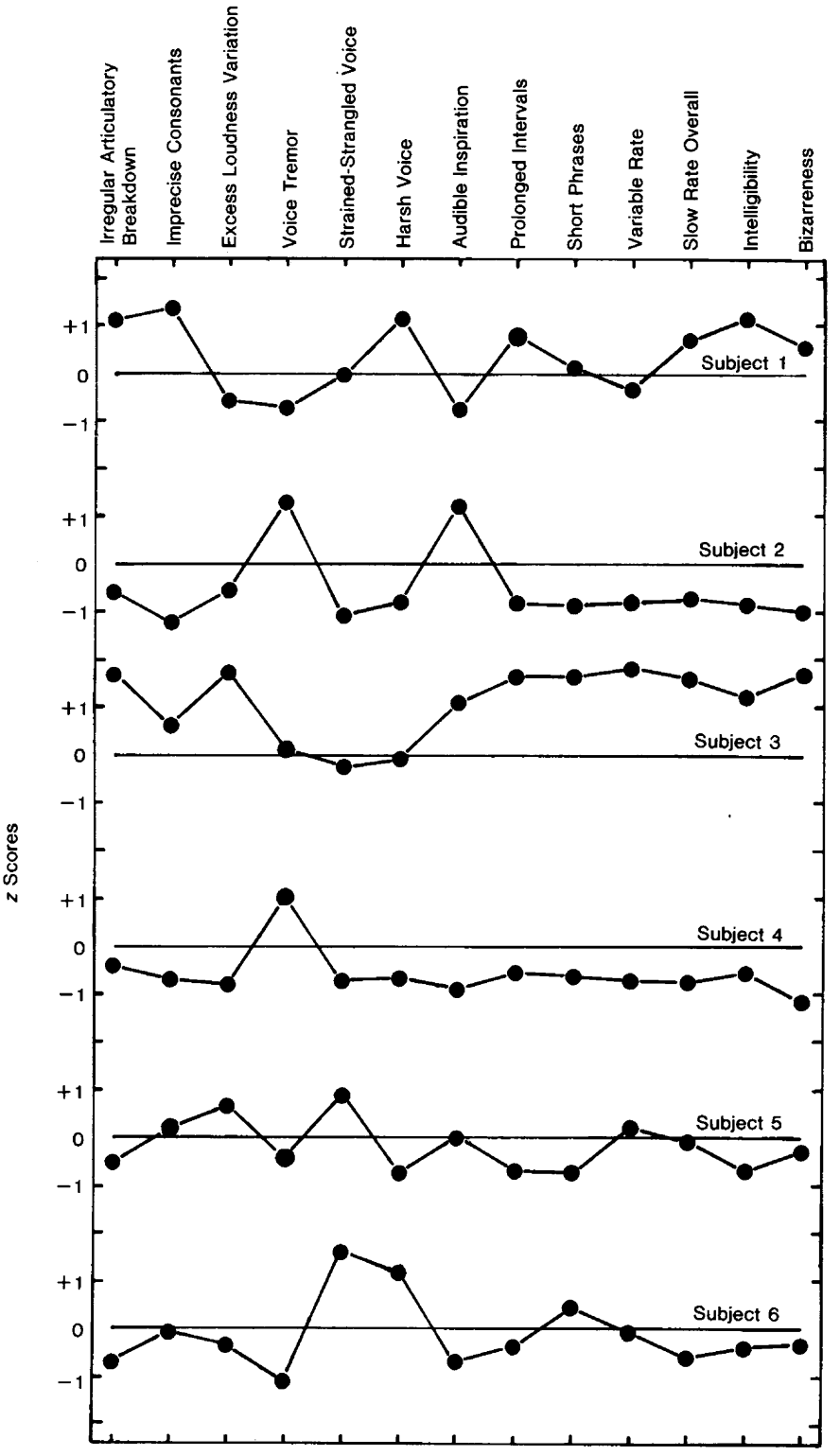
In the numerous descriptions of TD in the literature, there have been relatively few references to speech problems. Although Maxwell et al[1] reported on the speech disturbances observed in two patients with TD, the precise nature of the speech deviations was not specified. In a case report, Portnoy[2] described the speech deviations in a 50-year-old woman who had TD. The motor speech examination revealed irregular articulatory breakdowns, intermittent voice breaks, and monopitch and monoloudness of voice production. On the basis of these findings, he concluded that these speech abnormalities were consistent with the speech breakdown earlier identified in the Mayo Clinic dysarthria study[6] as hyperkinetic dysarthria in association with the

Table 3.—Correlations of Individual Speech Dimensions With Judgments of Intelligibility and Bizarreness

Dimension	Spearman r	Category
Intelligibility		
Prolonged intervals	.98	Timing
Short phrases	.94	Timing
Irregular articulatory breakdown	.83	Articulatory
Imprecise consonants	.77	Articulatory
Harsh voice	.77	Phonatory
Bizarreness		
Slow rate overall	.82	Timing
Prolonged intervals	.75	Timing
Short phrases	.69	Timing
Imprecise consonants	.67	Articulatory

slow hyperkinesias. In this latter study, the authors suggested that speech alterations in TD may be similar to those observed in a group of 30 patients with dystonia. They reported that the most prominent speech deviations in these patients were related to articulatory inefficiency, while phonatory dimensions were ranked slightly lower.

The findings of the present study are remarkable, first, for the marked degree of temporal disorganization and voice production impairment in these speech-impaired patients with TD relative to articulatory disturbance and, second, for the prominent midline truncal involvement. Whereas total mean AIMS and lingual-facial-buccal movements did not significantly differ in the two samples, involuntary movements of the trunk were frequent and often severe in the speech-impaired group. Such irregularities in truncal control, including diaphragmatic movements, have been described in patients with respiratory complaints and various forms of chorea.[7] Faheen et al described a similar patient with TD without extremity or orofacial dyskinesia, but with severe and bizarre respiratory irregularities, grunts, and dysarthric speech.[8] The finding that patients with truncal dyskinesia also tend to have speech abnormalities suggests that these two factors may, in fact, be linked. With the exception of such published anecdotes, the clinical description of TD generally has not stressed involvement of truncal and laryngeal musculature.[9] Laryngeal-pharyngeal dystonias have recently been discussed in relation to neuroleptic-associated asphyxia, without specific attention to speech abnormalities.[10]



Profiles of deviation from normal in 13 speech dimensions for six speech-impaired subjects having tardive dyskinesia.

The voice production deficits involving respiratory-phonatory systems were quite prominent. Four of the five voice dimensions (all but excess loudness variation) were among the first six dimensions in the ranking by severity of impairment. Although orofacial dyskinesia is the most widely recognized characteristic of TD,[9] this study documents the pronounced disruption of normal muscu-

lar movement in the respiratory-laryngeal systems, a deviation that contributes greatly to these patients' abnormal speech quality.

Articulation, although abnormal, was the subcategory least affected in these patients. This finding is somewhat surprising in that articulation is produced by movements of the orofacial structures that are prominently involved in TD. The articulatory breakdown was judged by listeners to be irregular and correlates with the clinical observation of the intermittent and seemingly random intrusion of the abnormal involuntary facial movements in TD. Particular phonemes were sometimes produced normally, while at other times they sounded imprecise or distorted. Although the articulatory dimensions were ranked quite low, alterations in articulation were associated with the overall evaluation of reduction in intelligibility and bizarre quality of speech.

The two most deviant dimensions were those related to temporal organization of speech, so that an erratic and disruptive rhythm characterized these patients. In addition, the high correlations that were found between the judgments of many of the timing dimensions and the overall dimensions of intelligibility and bizarreness illustrate the close relationship of the deviation in the prosodic dimensions to the evaluation of these two overall dimensions.

Unlike phonation and articulation, speech timing does not have a direct physiological correlate. An interaction of disturbances in motor control of respiration, phonation, and articulation often makes it difficult to determine which specific factors contributed to the breakdown in the rhythm of speech production. It is reasonable to expect that the presence of involuntary movements of the articulators not only would interfere with the accurate production of speech sounds, but would also block the smooth flow of speech production, resulting in an increased number of pauses, short phrasing, and the overall slow rate. Abnormal changes in respiration also may have contributed to deviation in speech timing. Difficulty in maintaining a normally steady expiration of air from the lungs may have been involved in the increased number of pauses, an increased duration of pausing between phrases, as shown in prolonged intervals; the occurrence of intermittent changes in rate, shown in variable rate; and the excess loudness variation.

Tardive dyskinesia can seriously impair the activities of daily life. Typically, patients have previously experienced a serious psychiatric disorder. The consequences of the additional problem of a prominent speech impairment can be especially devastating to these individuals. For some patients, such a disturbance in their speaking ability could substantially reduce the potential for rehabilitation and increase the duration of institutional care. The identification of disrupted speech components in TD may directly aid neurologists and speech pathologists to focus speech therapy techniques and develop new means to increase speech intelligibility in these patients.

This investigation was supported in part by national research service award NS07100 to Dr Gerratt and a teacher investigator award to Dr Goetz from the National Institute of Neurological and Communicative Disorders and Stroke; by the United Parkinson Foundation; and by the Boothroyd Foundation.

Joanne Robbins, Roger Colcorde, Danielle Koury-Parker, Richard Peach, Gail Kempster, and Brenda Dudley judged the speech samples. Shaun Brayton provided editorial assistance in the preparation of the manuscript. Douglas Noffsinger provided access to his computer.

References

1. Maxwell S, Massengill R, Nashold B: Tardive dyskinesia. *J Speech Hear Disord* 1970;35:33-36.

2. Portnoy RA: Hyperkinetic dysarthria as an early indication of impending tardive dyskinesia. *J Speech Hear Disord* 1979;44:214-219.

3. Fann WE, Stafford JR, Malone RL, et al: Clinical research techniques in tardive dyskinesia. *Am J Psychiatry* 1977;134:759-762.

4. *Abnormal Involuntary Movement Scale (AIMS)*, US Dept of Health, Education, and Welfare. Alcohol, Drug Abuse, and Mental Health Administration, 1974.

5. Fairbanks G: *Voice and Articulation Drillbook*. New York, Harper & Brothers, 1960.

6. Darley FL, Aronson AE, Brown JR: *Motor Speech Disorders*. Philadelphia, WB Saunders Co, 1975.

7. Weiner WJ, Goetz C, Nauseida PA, et al: Respiratory dyskinesias: Extrapyramidal dysfunction presenting as shortness of breath. *Ann Intern Med* 1978;88:327-331.

8. Faheen AD, Brightwell DR, Burton GC, et al: Respiratory dsykinesia and dysarthria from prolonged neuroleptic use: Tardive dyskinesia? *Am J Psychiatry* 1982;139:517-518.

9. Marsden CD, Tarsy D, Baldessarini RJ: Spontaneous and drug induced movement disorders in psychotic patients, in Benson DF, Blumer D (eds): *Psychiatric Aspects of Neurologic Disease*. New York, Grune & Stratton Inc, 1975, pp 219-265.

10. Flaherty JA, Lahmeyer HW: Laryngeal-pharyngeal dystonia as a possible cause of asphyxia with haloperidol therapy. *Am J Psychiatry* 1978;135:1414-1415.