



ORIGINAL ARTICLE

Speech rate in Parkinson's disease: A controlled study[☆]



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Abstract

Introduction: Speech disturbances will affect most patients with Parkinson's disease (PD) over the course of the disease. The origin and severity of these symptoms are of clinical and diagnostic interest.

Purpose: To evaluate the clinical pattern of speech impairment in PD patients and identify significant differences in speech rate and articulation compared to control subjects. Speech rate and articulation in a reading task were measured using an automatic analytical method.

Patients: A total of 39 PD patients in the 'on' state and 45 age- and sex-matched asymptomatic controls participated in the study. None of the patients experienced dyskinesias or motor fluctuations during the test.

Results: The patients with PD displayed a significant reduction in speech and articulation rates; there were no significant correlations between the studied speech parameters and patient characteristics such as L-dopa dose, duration of the disorder, age, and UPDRS III scores and Hoehn & Yahr scales.

Conclusion: Patients with PD show a characteristic pattern of declining speech rate. These results suggest that in PD, disfluencies are the result of the movement disorder affecting the physiology of speech production systems.

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PALABRAS CLAVE

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Velocidad de elocución;
Velocidad articulatoria;
L-dopa

Estudio controlado del ritmo del habla en la enfermedad de Parkinson**Resumen**

Introducción: Las alteraciones en el habla aparecen en la mayoría de los pacientes con la enfermedad de Parkinson (EP) en el curso del trastorno. Su origen y gravedad son de interés clínico y diagnóstico.

Objetivo: Evaluar los patrones de deterioro en el habla en pacientes con la EP, e identificar diferencias en la velocidad de elocución y articulación en comparación con sujetos de control, empleando un método de análisis automático en una tarea de lectura.

Pacientes: Participaron 39 pacientes con la EP y 45 controles asintomáticos igualados en sexo y edad. Los pacientes con la EP, en estado *on*, no presentaban fluctuaciones motoras ni discinesias durante la evaluación del habla.

Resultados: El grupo de pacientes con la EP muestran una significativa reducción de la velocidad de elocución y articulación. No se encontraron correlaciones significativas entre los parámetros del habla estudiados y las características de los pacientes, tales como la dosis de L-dopa, duración del trastorno, edad, ni en las puntuaciones en las escalas UPDRS III o Hoehn y Yahr.

Conclusiones: Los pacientes con la EP muestran un patrón característico de deterioro del ritmo del habla. Estos resultados indican que las disfluencias en la EP son el resultado de la alteración del movimiento que afecta a la fisiología de los sistemas de producción del habla.

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Hypokinetic dysarthria is a frequent complication in Parkinson's disease (PD), affecting a sizeable percentage of patients.¹ Its prevalence increases with disease progression.

Parkinsonian speech is typically monotonous and aprosodic, with progressive decreases in vocal sonority and intensity at the end of the phonation. It is characterised by delayed voice onset time and long pauses to breathe between words and syllables, resulting in decreased fluency and tempo. Articulation is impaired,² which inevitably affects speech intelligibility and makes it difficult to recognise a patient's emotional state.³

PD is also associated with other speech and voice alterations: decreased ability to initiate speech, then followed by rapid speech (tachylalia), rapid repetition of words (palilalia), and on occasions the tip of the tongue phenomenon. In addition, voice intensity decreases progressively (hypophonia).¹ Many of these alterations are associated with hyperdopaminergic states.^{4,5}

The acoustic characteristics of dysarthric speech in patients with PD reflect the physiological and anatomical changes caused by dopaminergic deficits, including tremor, bradykinesia, muscle rigidity, and postural instability. These changes affect the 3 subsystems linked to motor control of speech: the respiratory, phonatory, and articulatory systems. Rigidity associated with PD affects the respiratory system (which manages the proper airflow and pressure to generate phonation), thereby altering the range of articulatory movements and the ability to modulate vocal intensity. Alterations of the phonatory system mainly affect vocal cord vibration, which results in increased fundamental frequency (F0) and a reduction in speech variability, intonation, and melodic curve. Finally, the articulatory system is also impaired as the disease progresses, leading to imprecise articulation and increased duration of pauses, which are caused by the decreased amplitude of articulatory movements.⁶

Speech rate (number of sounds a person can produce in a unit of time, including pauses) and articulation rate (number of sounds excluding pauses) are frequently studied in the context of PD. The data from the literature are inconsistent: some authors⁷⁻⁹ reported significant reductions in speech rate when patients were asked to repeat a series of syllables (/pa/, /ta/, /ka/) at a rapid pace, whereas others observed the opposite effect.^{10,11}

Increased speech rate has also been observed during tasks used to evaluate continuous speech (usually reading short texts).^{12,13} Other studies, however, have found no intergroup differences,¹⁴ or else report a decrease in speech rate. Two longitudinal studies illustrate a progressive decline in speech rate over periods ranging from 25 to 32 months.^{15,16}

Speech rate is essentially dependent on the number and duration of pauses. Results regarding pauses are also contradictory: whereas several studies^{17,18} found no differences in pause number or duration during a reading task, other studies report significant increases in pauses^{12,13} or the use of fewer yet longer pauses.¹⁹

In addition to reducing hypokinesia and rigidity of the systems involved in speech production, levodopa can be expected to increase speech rate. However, results from multiple studies do not support this theory. Whereas some researchers^{12,20,21} have found no differences in speech rate between 'on' and 'off' periods, others²² report significant improvements during the 'on' period. Likewise, deep brain stimulation of the subthalamic nucleus does not seem to have a significant effect on speech rate^{22,23}; although it may improve speech parameters in some patients,²⁴ this normally does not improve overall intelligibility.²⁵ Many of these inconsistencies may be attributed to small sample sizes (2 to 30 participants), the lack of published assessments of subjects' cognitive functions, and other aspects associated with the methodology of speech analysis.²⁶

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