

# Early detection of Parkinson's disease by voice analysis

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A new technique assisting in early diagnosis of Parkinson's disease has been developed by Prof. Shimon Sapir of the Department of Communication Sciences and Disorders at the University of Haifa. This technique involves analysis of voice and articulation. The research was carried out alongside U.S. scientists and with funding from the National Institutes of Health (NIH), and results have been published in the *Journal of Speech, Language, and Hearing Research*. "This is a non-invasive, reliable and accurate technique that only requires the patient to read out a few simple sentences," Prof. Sapir explains.

Characteristic symptoms of [Parkinson's disease](#) include a rigidity of muscles, tremors, slow movement, and loss of balance. The disease is frequently diagnosed based on these symptoms - and the problem with that is that these symptoms generally occur when the disease is already more advanced and diagnosis is made when some 60% of the [nerve cells](#) in the area of the brain that controls motor activity are already damaged. Such late diagnosis compromises the effectiveness of therapy and rehabilitation.

According to Prof. Sapir, the muscles controlling voice and speech are also affected by the disease in most patients, and there is some evidence suggesting that speech abnormalities may antecede the classic symptoms of the disease. He adds that theoretically, an acoustic analysis of voice is sensitive enough to help detect subtle abnormalities in speech that are present in the early stages of the disease but are not perceptible to listeners.

"Statistically speaking, the existing acoustic tests did not pick up significant differences between speech articulation of individuals with early PD and the speech of healthy individuals, even when such differences were sometimes already noticeable to the listener," Prof. Sapir points out, and suggest that "this failure to detect acoustic differences has to do with the relatively large differences between speakers' speech signals, which is mainly due to anatomical differences between speakers". The method developed by Prof. Sapir minimizes the effects of speaker variability and maximizes the sensitivity of the acoustic analysis to true differences between the speech of individuals with PD and that of healthy speakers.

Prof. Sapir and his colleagues tested the utility of the acoustic analysis method. One study tested two groups: one group of individuals with PD and another group of healthy individuals. The participants recorded a number of sentences which were then put through [acoustic analysis](#) with the program that was designed for this particular purpose. The system was able to make a clear differentiation between the two groups of participants. In another study the speech of individuals with PD at stages I and II of the disease (out of 5 stages) was compared to the speech of healthy individuals. At this stage of the study, too, the system was able to distinguish the PD group from the healthy group. An additional study applied the acoustic method to compare the speech of individuals with PD before and after successful behavioral speech therapy. The results showed that the analysis system was sensitive to changes that occurred in those patients who had undergone therapy for speech. Importantly, scientists in Germany who used Prof. Sapir's method have also reported revealing significant differences between speakers with early stages of PD and healthy speakers with normal speech. Collectively, these findings indicate that the method developed by Prof. Sapir not only enables early diagnosis of PD but also makes it possible to track changes in PD patients that may occur in response to treatment or as the disease progresses.

"Doctors and scientists agree that early diagnosis of PD is important in order to slow down or even prevent the degenerative progress of this disease. Today no treatment is available to this effect, but when treatment becomes feasible, early diagnosis is going to be crucial. There are various methods of brain imaging for detecting early signs of PD, but these methods are expensive - particularly when attempting to screen a large population at risk. Hence the importance of developing techniques for early diagnosis that are valid, reliable, non-invasive, simple, readily available, and inexpensive," Prof. Sapir explains. He stresses that "while our initial results are very encouraging, additional studies must be carried out in order to examine the new method. Also, given that the disease and its progression have different effects on individuals, speech analysis must be incorporated into a battery of tests that examine other signs and symptoms of the disease, such as changes in handwriting, cognitive functions, sense of smell, and more."

Provided by University of Haifa

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