Deep brain stimulation may contribute to dysarthria in patients with Parkinson’s disease as detected by objective measures

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Abstract

Dysarthria is found in approximately 80% of patients with Parkinson’s Disease (PD) and significantly limits communication as the severity worsens. Surgical implantation of deep brain stimulation (DBS) into the subthalamic nucleus (STN) has become more common and is an effective treatment for the motoric symptoms of PD. Objective measures of the effect of DBS or speech is sparsely described. We have developed computer algorithms that quickly and objectively analyze the speech of PD patients, allowing clinicians to assess the effect of speech on DBS programming or other therapies. In 10 PD patients and 12 Normal subjects were recorded during speech tasks using a solid state digital recorder. Their speech was analyzed using our algorithms, which provide objective measures of speech production, such as rate, regularity, and other quantities. Rate and regularity assess speech agility, while standardization is a measure of articulatory precision.

Specific aims of this project:

1. Reflect acoustic features corresponding to the larynx and major articulators. The measurements are standard components of an oral passage, to determine if speech rate is slower for all speech tasks, not just the /ka/.

2. This task assesses the respiratory and tonal aspects of the voice, pitch, and rate. Patients repeat three monosyllabic phrases in rapidly and accurately as possible: /pa-pa-pa/ for “pa-pa-pa” and /ta-ta-ta/ for “ta-ta-ta…”.

3. This task determines the effect of speech of varying DBS settings on each patient. It involves the repeated production of three sounds included in the NASH sounds. The phrases are /ta-ta-ta/ and /ka-ka-ka/.

4. This task assesses the neurological and cognitive contributions of speech. The subject dictates the length of each syllable, from short to long, with a target syllable. The phrases are /ta-ta-ta/ and /ka-ka-ka/.

5. This measure examines and compares the range of motion of the jaws, lips, and tongue. Patients repeat three monosyllabic phrases in rapidly and accurately as possible: /pa-pa-pa/ for “pa-pa-pa” and /ka-ka-ka/ for “ka-ka-ka”.

6. This task assesses the respiratory and tonal aspects of the voice, pitch, and rate. Patients repeat three monosyllabic phrases in rapidly and accurately as possible: /pa-pa-pa/ for “pa-pa-pa” and /ta-ta-ta/ for “ta-ta-ta…”.

7. The data this study yields can help us to:

- Refine measurements that can be made automatically on speech to help optimize DBS settings.
- Develop a tool to quantify the effects of PD progression and treatments.
- Positive correlation with speech rate.

Candidates for this study are patients with PD whose symptoms can no longer be managed by medication alone. We are currently recruiting a total of 12 patients for this study; 3 are female and 12 male. All patients were recorded from several weeks to a few months and were recorded each time.

In addition, 8 normal subjects (6 female, 2 male), age range 26-61, were recruited as controls, each age. The recordings of one normal female subject were taken during each condition. The recordings of one normal female subject were excluded due to perceptual and measured anomalies.

Methods

Why Speech? Ability to communicate with others is important to the quality of life in PD patients, and is important to improve speech along with other motor functions. Also, speech measurements are non-invasive and easy to make.

Why The Tests and Measurements We Chose? The tests are standard components of an oral passage, including the tonal and major articulators. These measurements reflect acoustic features corresponding to the larynx and major articulators. The measurements reflect comprehensive features of the speech process that are described in Parkinsonians.

Specific aims of this project:

1. Reflect acoustic features corresponding to the larynx and major articulators. The measurements reflect comprehensive features of the speech process that are described in Parkinsonians.

2. Our goal for this project is to refine and assess objective measures of speech and dysarthria. Our goal for this project is to refine and assess objective measures of speech and dysarthria.

3. Development of computer algorithms is an important area of investigation. The speech function has been described in a variety of ways, using different approaches. It is important to improve speech along with other motor functions. Also, speech measurements are non-invasive and easy to make.

4. The data this study yields can help us to:

- Refine measurements that can be made automatically on speech to help optimize DBS settings.
- Develop a tool to quantify the effects of PD progression and treatments.
- Positive correlation with speech rate.

Subjects

Subjects

Careful selection of patients is based on the effectiveness of DBS for speech in PD. The specific inclusion criteria are:

1. Candidates for this study are patients with PD whose symptoms can no longer be managed by medication alone. We are currently recruiting a total of 12 patients for this study; 3 are female and 12 male. All patients were recorded from several weeks to a few months.

2. All patients were recorded once each. The recordings of one normal female subject were taken during each condition.

3. The recordings of one normal female subject were excluded due to perceptual and measured anomalies.

Results

Summary

1. The data this study yields can help us to:

- Refine measurements that can be made automatically on speech to help optimize DBS settings.
- Develop a tool to quantify the effects of PD progression and treatments.
- Positive correlation with speech rate.

2. The data this study yields can help us to:

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- Refine measurements that can be made automatically on speech to help optimize DBS settings.
- Develop a tool to quantify the effects of PD progression and treatments.
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- Refine measurements that can be made automatically on speech to help optimize DBS settings.
- Develop a tool to quantify the effects of PD progression and treatments.
- Positive correlation with speech rate.

9. The data this study yields can help us to:

- Refine measurements that can be made automatically on speech to help optimize DBS settings.
- Develop a tool to quantify the effects of PD progression and treatments.
- Positive correlation with speech rate.

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- Develop a tool to quantify the effects of PD progression and treatments.
- Positive correlation with speech rate.