The Long-Term Effects of the SpeechVive Device for Speakers with Parkinson’s Disease
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Background
Over 80% of individuals with Parkinson’s Disease (PD) develop speech impairments. Perceptually, speakers with PD develop hypokinetic dysarthria, characterized by increased speech rate, reduced loudness, and a hoarse, breathy vocal quality.

The respiratory and laryngeal subsystems play crucial roles in the production and maintenance of steady subglottic air pressure and vocal intensity during speech. People with PD experience physiological changes to these systems characterized by increased speech rate, reduced loudness, and a hoarse, breathy vocal quality.

Over 80% of individuals with Parkinson’s Disease (PD) develop speech impairments. Perceptually, speakers with PD develop hypokinetic dysarthria, characterized by increased speech rate, reduced loudness, and a hoarse, breathy vocal quality. The respiratory and laryngeal subsystems play crucial roles in the production and maintenance of steady subglottic air pressure and vocal intensity during speech. People with PD experience physiological changes to these systems which compromise speech production. Compared to healthy adults people with PD:

- Have weaker and less coordinated respiratory muscles
- Use greater abdominal muscle contributions
- Rely on greater amounts of active than passive forces
- Have bowed vocal folds that do not close rapidly or completely

The SpeechVive device shows promise to be an effective speech treatment for people with PD. The SpeechVive is a wearable device which elicits the Lombard Effect during speech by playing multi-talker babble noise. The SpeechVive has previously been found to:

- Improve the efficiency of speech breathing
- Increase vocal intensity and laryngeal aerodynamics

While the short-term effects of the SpeechVive are known, the present study examines long-term effects of the SpeechVive device on respiratory and laryngeal speech functions for speakers with PD.

Methods
Participants and procedures:
- 12 individuals with PD (9 males, 3 females)
- Mean age: 71.25 years (SD: 6.37 years)
- 2-minute monologue (acoustic and respiratory data)
- Carrier sentence (laryngeal data)

SpeechVive
8 weeks
no treatment
4 weeks
SpeechVive
24 weeks
Pre1
Post1
Pre2
Post2

Acoustic Data

- Sound Pressure Level (SPL)
- Utterance Length (# of syllables)
- Speech and articulation rates
- Pause patterns (# of pauses, % breath pauses, % non-breath pauses, average duration of pauses)

Laryngeal Data

- Maximum flow declination rate
- Open Quotient
- AC flow
- DC flow

Laryngeal Variables

Results

Respiratory Data

- % vital capacity per syllable
- Lung volume initiation
- Lung volume termination
- Lung volume excursion

Respiratory Variables

Mixed model ANOVA with repeated measures, subject as a random factor. Session (Pre1, Post1, Pre2, Post2) and condition (SpeechVive on/off) were included as factors. Significant effects were examined post-hoc using Tukey’s honestly significant difference (HSD).

SpeechVive
8 weeks
no treatment
4 weeks
SpeechVive
24 weeks
Pre1
Post1
Pre2
Post2

SPL: Main effect of condition (p<.0001; off < on) and session (p<.0001; Pre1 < Pre2 < Post1 < Post2).

Speech Rate: Main effect of session (p=.0092; Pre1 < Pre2, Post1 < Post2).

LVT: Main effect of condition (p<.0001) and a session x condition effect (p = .0031; Pre1 off < Pre2 on, Post1 off < Post2 on, Post2 off < Pre1 on, Post2 off < Post2 on)

LVE: Main effect of condition (p=.0004; Pre1, Post1, and Post2 < Pre2).

Discussion

- Long-term use of the SpeechVive is a viable speech treatment source.
- Speech breathing becomes more efficient. Speakers take advantage of higher recoil forces.
- Loudness continues to increase both with and without the SpeechVive on.
- Speech rate approaches normative and baseline values during the long term treatment phase.
- Speakers use more laryngeal valving to increase loudness.
- Users of the SpeechVive do not acclimate to the device.

This project was supported, in part, with support from the Indiana Clinical and Translational Sciences Institute funded, in part by Grant Number TL1TR002531 from the National Institutes of Health, National Center for Advancing Translational Sciences, Clinical and Translational Sciences Award. NIDCD-R01DC9409

References