A Comparison of Two Forms of Intensive Voice Treatment for Parkinson's Disease

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INTRODUCTION

- Two forms of voice treatment, LSVT LOUD® and the SpeechVive™, are effective at increasing vocal intensity in persons with Parkinson's Disease (PD) [1,2]
- LSVT LOUD and the SpeechVive differ substantially in cue type, with LSVT LOUD relying on internal cueing and the SpeechVive providing external cueing to elicit increased vocal intensity
- Internal and external cues differentially affect motor responses in PD, including during speech production [3,4]
- **RESEARCH AIM 1:** Examine the effect of internal and external loudness cueing on speech and pause characteristics in individuals with PD
- **RESEARCH AIM 2:** Examine how internal versus external cueing affects patient perception of physical and mental effort during voice intervention

METHODS

PARTICIPANTS

- Participants with idiopathic PD were assigned to one of two treatment groups:
  - LSVT LOUD, *n*=9 (Mean age=69 years, *SD*±10 years)
  - SpeechVive, *n*=9 (Mean age=68 years, SD±4 years)
- No recent (within one year) history of speech therapy
- Mild to moderate hypophonia; Hoehn & Yahr stage 2-3
- Pharmacological management of PD symptoms

TREATMENT PROGRAM

- **LSVT LOUD**
  - Standard LSVT® LOUD protocol was administered by LSVT LOUD-certified clinician unaffiliated with the study
  - Additional four weeks of home practice facilitated by LSVT LOUD Homework Helper
- **SpeechVive**
  - Participants wore the device 2-8 hours per day during communication for eight weeks
  - Participants were instructed to read aloud 30 minutes daily
  - SpeechVive amplitude adjusted at onset and biweekly to elicit 3-5dB increase in SPL during conversational speech
  - No behavioral therapy was provided

ACOUSTIC DATA COLLECTION

- Omnidirectional head-mounted microphone at fixed distance
- Speakers completed oral reading of the California passage
  - LSVT-LOUD therapist not present
  - SpeechVive device was not worn

METHODS

RESEARCH AIM 1: ACOUSTIC

- Acoustic measures were completed using PRAAT scripting [5]
- Silent intervals ≥ than 150 ms were identified and labeled as pauses using wide-band spectrogram and waveform displays
- The following acoustic measures were captured for the California reading passage at three time points (Baseline, 4 weeks, 8 weeks)
  - **Sound Pressure Level (dB SPL):** Mean intensity level across speech runs (excluded silent intervals ≥ 150ms)
  - **Articulation Rate:** Number of syllables divided by sentence duration (excluded silent intervals ≥ 150ms)
  - **Average Pause Frequency:** Total number of pauses across sentences divided by the total number of sentences
  - **Average Pause Duration:** Sum of pause duration across sentences divided by total number of pauses

RESEARCH AIM 2: PHYSICAL & MENTAL EFFORT

- Perceptions of physical and mental effort were examined using a modified version of the National Aeronautics and Space Administration Task Load Index (NASA-TLX)
- NASA-TLX was completed by each participant at the end of each treatment or home practice session
- Higher scores reflect perception of increased effort

STATISTICAL ANALYSIS

RESEARCH AIM 1: ACOUSTIC

- A mixed model repeated-measures ANOVA was used to study each outcome measure independently
- Within-subject factor of Session (pre, 4-weeks, 8-weeks)
- Between-subject factor of Group (LSVT LOUD, SpeechVive)
- Participant was included as a random effect in the model to account for expected inter-subject differences in response to treatment
- Bonferroni adjusted *p*-values were used to account for multiple comparisons
- A mean intra-class correlation coefficient (ICC) of 0.985 was reported across dependent measures (ICC range = 0.963-0.993) indicated strong agreement between the original and independent examiner

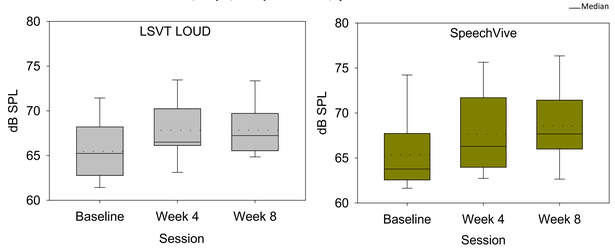
RESEARCH AIM 2: PHSYICAL AND MENTAL EFFORT

- Each domain score (physical/mental effort) was analyzed using a one-way ANOVA to compare Groups (LSVT LOUD, SpeechVive)

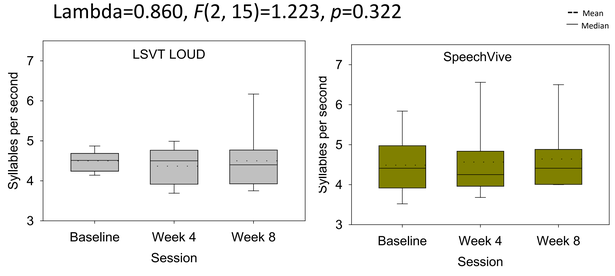
RESULTS

RESEARCH AIM 1: ACOUSTIC

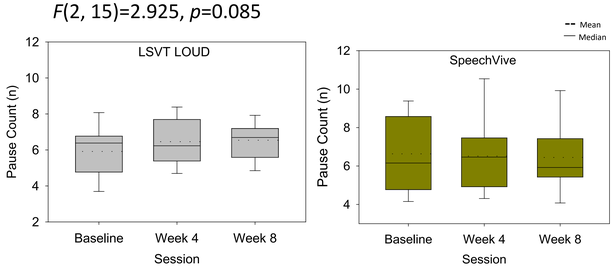
- **Sound Pressure Level (dB SPL):** Significant effect of Session, Wilk's Lambda=0.269, $F(2, 15)=20.377$, $p<.0001$, $n^2=0.731$
  - Post > Pre, $t(17)= -6.145$, $p<.001$
  - Mid > Pre, $t(17)= -5.425$, $p<.001$
  - No significant effect of Session by Group, Wilk's Lambda=0.929, $F(2, 15)=0.577$, $p=0.574$



- **Articulation Rate:** No significant effect of Session, Wilk's Lambda=0.913, $F(2, 15)=0.718$, $p=0.504$
  - No significant effect of Session by Group, Wilk's Lambda=0.860, $F(2, 15)=1.223$, $p=0.322$

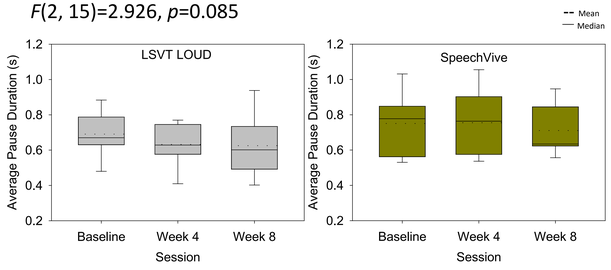


- **Average Pause Frequency:** No significant effect of Session, Wilk's Lambda=0.901, $F(2, 15)=0.821$, $p=0.459$
  - No significant effect of Session by Group, Wilk's Lambda=0.719, $F(2, 15)=2.925$, $p=0.085$



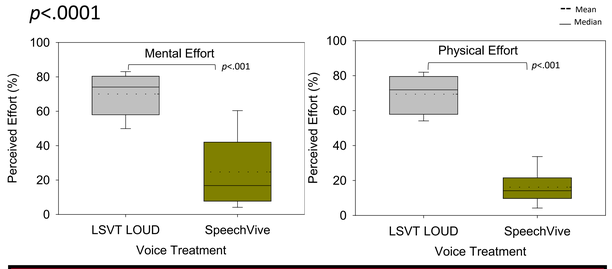
RESULTS

- **Average Pause Duration:** Significant effect of Session, Wilk's Lambda=0.559, $F(2, 15)=5.906$, $p=0.013$
  - Post <Pre, $t(17)= 3.155$, $p=.006$
  - Mid < Pre, $t(17)= 2.319$, $p=.033$
- No significant effect of Session by Group, Wilk's Lambda=0.719, $F(2, 15)=2.926$, $p=0.085$



RESEARCH AIM 2: PHYSICAL & MENTAL EFFORT

- **Mental Effort:** Significant Group difference, $F(1, 16)=33.130$, $p<.0001$
- **Physical Effort:** Significant Group difference, $F(1, 16)=126.388$, $p<.0001$



CONCLUSION

- LSVT LOUD and training with the SpeechVive result in similar improvements to SPL and a decrease in pause duration post-tx
- Neither treatment had appreciable effects on articulation rate or pause frequency in the current study
- SpeechVive training was significantly less physically and mentally effortful than LSVT LOUD

REFERENCES

1. Ramig, L.O., Sapir, S., Fox, C., & Countryman, S. (2001). Changes in vocal loudness following intensive voice treatment (LSVT) in individuals with Parkinson's disease: a comparison with untreated patients and normal age-matched controls. Movement Disorder, 16(1), 79-83.
2. Stathopoulos, E., Huber, J.E., Richardson, K., Kamphaus, J., Fulcher, K., DeCicco, D., Darling, M., & Sussman,J.E. (2014). Increased vocal intensity due to the Lombard effect in speakers with Parkinson's disease: Simultaneous laryngeal and respiratory strategies. Journal of Communication Disorders, 48, 1-17.
3. De Icco, R., Tassorelli, C., Berra, E., Bolla, M., Pacchetti, C., & Giorgio, S. (2015). Acute and Chronic Effect of Acoustic and Visual Cues on Gait Training in Parkinson's Disease: A Randomized, Controlled Study. Parkinson's Disease, 1-9.
4. Lohnes, C.A., & Earhart, G.M. (2011).The impact of attentional, auditory, and combined cues on walking during single and cognitive dual tasks in Parkinson disease. Gait Posture, 33(3), 478-483.
5. Boersma, P., Weenink, D. Praat (5.1.32). Amsterdam, The Netherlands: Publisher; 2010. Available from http://www.fon.hum.uva.nl/praat.