DELIVERY OF TELESPEECH SERVICES FOR INDIVIDUALS WITH PARKINSON’S DISEASE

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The University of North Carolina at Greensboro
Disclosure

• Financial interest:
  • There is no personal financial interest for equipment and/or services discussed in this presentation.
  • 7% of Campbell’s salary was paid through the HRSA grant.

• Non-financial interest:
  • Campbell is the current CE Manager for SIG#18 on Telepractice, as well as the chair of the American Telemedicine Association’s (ATA) Special Interest Group on Telerehabilitation.
The University of North Carolina at Greensboro Experience
Purpose of the Project

• The primary purpose of this project was to assess the clinical effectiveness of a secure home telerehabilitation application for evaluating and treating speech and voice disorders associated with Parkinson’s disease and hypokinetic dysarthria.
Previous Studies

- Constantinescu, et al (2010a)
- Constantinescu, et al (2010b)
- Theodoros & Ramig (2011)
Telespeech Patient System
LSVT Companion® System
Calibrated Microphone
Tandberg Edge 95 MXP
Document Camera
DVD Recorder
Remote Desktop Application

GoToMyPC®
Network and Bandwidth Considerations

- High Bandwidth connection
  - more information can travel between sites in a given amount of time

- Low Bandwidth connection
  - less information can travel between sites in a given amount of time
Clinician calls patient by phone to confirm availability

Clinician walks patient through computer startup

Clinician calls patient computer with Movii

Clinician connects to patient computer with Remote Access software

Do patient’s LSVT targets need to be updated?

Yes

Clinician copies new targets' file from clinic computer to LSVT_Data folder on patient desktop

No

Clinician controls patient computer and starts LSVT session

Patient completes LSVT session with clinician supervision

Clinician copies 'results' file from LSVT_Data folder on patient desktop to clinic computer

Clinician closes Remote Access connection

Clinician reminds patient to turn off computer when session is complete

Clinician ends Movii call

Clinician reviews 'results' file

Clinician updates 'targets' file

Home-based LSVT Treatment Protocol
Process Diagram (v1)
MOVI 4.0 System
(Tandberg VCS Expressway, Content Server & TMS Server)
H.264: Media communication uses 4 ports: RTCP Audio, RTP Audio, RTCP video & RTP video. The port numbers used will be consecutive, but chosen randomly within the possible range.

Either:
- SIP unencrypted: 1 port required
- SIP encrypted: 1 port required

Movis to Movis traversal call through the VCS Expressway.
Study Design

• A pretest-posttest design, with a single experimental group was used to assess the effectiveness of LSVT LOUD administered via telehealth.
Participants

• Inclusion Criteria
  • Age 18 or over and high school graduate
  • Native speaker of English
  • Diagnosis of idiopathic Parkinson’s disease
  • Stable, consistent drug regimen for Parkinson’s disease
  • No prior speech therapy for Parkinson’s-related difficulties
  • Laryngoscopic examination of the vocal folds by an ENT showing no vocal fold pathology
  • Aided hearing thresholds of 30 dB
  • Unable to access the Lee Silverman Voice Treatment program
  • Internet access at participants home
Participants

- 8 participants
  - 3 male
  - 5 female
- All had a diagnosis of Idiopathic Parkinson’s Disease (IPD)
- Age range 59-80 years (mean age 64.8 years)
- Range of years post IPD diagnosis 1-16 (mean years post IPD diagnosis 7.4)
- All patients receiving drug regimen for IPD.
- Laryngoscopic evaluation conducted by ENT or SLP pre-treatment to confirm no vocal fold pathology
Assessment and Treatment

• Both assessment an treatment were delivered via telerehabilitation with the patient in their home.

• Assessments and treatments were administered by clinician or graduate clinicians from UNCG who have LSVT LOUD certification.
Assessment

- Interview/Questionnaire
- Levels of pitch, loudness, and duration as per LSVT LOUD protocol
  - Pitch highs and lows on “ah” phonation
  - Loudness and duration on “ah” phonation
  - “Grandfather” passage
- Spontaneous word generating
- Conversation
Assessment (cont)

- Assessment of Intelligibility of Dysarthric Speech
  (ASSIDS)
- Consensus Auditory-Perceptual Evaluation of Voice
  (CAPE-V)
- Perceptual Rating Form
- Voice Handicap Index
- Post-treatment satisfaction Questionnaire
Treatment

- Followed LSVT LOUD protocol using the LSVT Companion software.
- Intensive one hour sessions delivered 4 times a week for four weeks (as described by Ramig et al., 2001).
  - One patient received 5 weeks of therapy
- Daily homework tasks completed once on days with therapy and twice on days without therapy.
- Carryover activities completed daily.
Loud “ah”
High’s and Low’s
Functional Phrases
Words
Conversation
### Results

#### Pitch, Loudness, and Duration As Per LSVT Protocol

<table>
<thead>
<tr>
<th></th>
<th>Pre-Therapy</th>
<th>Post Therapy</th>
<th>Significance p&lt;0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sustained “Ah” Loudness (DB)</strong></td>
<td>72.331</td>
<td>83.7375</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>Sustained “Ah” Duration (Sec)</strong></td>
<td>16.819</td>
<td>17.650</td>
<td>0.780</td>
</tr>
<tr>
<td><strong>“Ah” Pitch High (Hz)</strong></td>
<td>431.829</td>
<td>617.163</td>
<td>0.009</td>
</tr>
<tr>
<td><strong>“Ah” Pitch Low (Hz)</strong></td>
<td>146.675</td>
<td>128.100</td>
<td>0.007</td>
</tr>
<tr>
<td><strong>Pitch Range (Hz)</strong></td>
<td>285.141</td>
<td>489.063</td>
<td>0.007</td>
</tr>
<tr>
<td><strong>Loudness Reading (DB)</strong></td>
<td>71.471</td>
<td>78.214</td>
<td>0.004</td>
</tr>
<tr>
<td><strong>Loudness Word Generating (DB)</strong></td>
<td>69.100</td>
<td>72.975</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Loudness Conversation (DB)</strong></td>
<td>71.675</td>
<td>74.9125</td>
<td>0.009</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Voice Handicap Index (VHI)</th>
<th>Pre-Therapy</th>
<th>Post Therapy</th>
<th>Significance p&lt;0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>20.857</td>
<td>12.857</td>
<td>0.044</td>
</tr>
<tr>
<td>Functional</td>
<td>19.714</td>
<td>10.286</td>
<td>0.000</td>
</tr>
<tr>
<td>Emotional</td>
<td>15.571</td>
<td>9.143</td>
<td>0.053</td>
</tr>
<tr>
<td>Total Score</td>
<td>56.142</td>
<td>32.286</td>
<td>0.007</td>
</tr>
</tbody>
</table>
## Results

### Assessment of Intelligibility of Dysarthric Speech (ASSIDS)

<table>
<thead>
<tr>
<th></th>
<th>Pre-Therapy (%)</th>
<th>Post Therapy (%)</th>
<th>Significance p&lt;0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Words</strong></td>
<td>61.750</td>
<td>72.000</td>
<td>0.155</td>
</tr>
<tr>
<td><strong>Sentences</strong></td>
<td>83.031</td>
<td>91.740</td>
<td>0.056</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)</th>
<th>Pre-Therapy</th>
<th>Post Therapy</th>
<th>Significance p&lt;0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Severity</td>
<td>48.250</td>
<td>17.250</td>
<td>0.000</td>
</tr>
<tr>
<td>Roughness</td>
<td>33.875</td>
<td>12.625</td>
<td>0.024</td>
</tr>
<tr>
<td>Breathiness</td>
<td>16.500</td>
<td>6.500</td>
<td>0.041</td>
</tr>
<tr>
<td>Strain</td>
<td>21.125</td>
<td>11.750</td>
<td>0.158</td>
</tr>
<tr>
<td>Pitch Variability</td>
<td>38.125</td>
<td>10.750</td>
<td>0.005</td>
</tr>
<tr>
<td>Loudness</td>
<td>51.375</td>
<td>13.500</td>
<td>0.004</td>
</tr>
</tbody>
</table>
## Results

### Perceptual Rating Form

<table>
<thead>
<tr>
<th></th>
<th>Pre-Therapy</th>
<th>Post Therapy</th>
<th>Significance p&lt;0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always Loud Enough</td>
<td>48.940</td>
<td>70.079</td>
<td>0.039</td>
</tr>
<tr>
<td>Never Shaky Voice</td>
<td>69.981</td>
<td>79.424</td>
<td>0.235</td>
</tr>
<tr>
<td>Never Hoarse</td>
<td>72.877</td>
<td>84.651</td>
<td>0.031</td>
</tr>
<tr>
<td>Never Monotonous</td>
<td>52.510</td>
<td>72.586</td>
<td>0.144</td>
</tr>
<tr>
<td>Never Slurs</td>
<td>69.401</td>
<td>72.974</td>
<td>0.622</td>
</tr>
<tr>
<td>Never Strained</td>
<td>58.591</td>
<td>71.236</td>
<td>0.128</td>
</tr>
<tr>
<td>Never Mumbles</td>
<td>57.626</td>
<td>69.209</td>
<td>0.192</td>
</tr>
<tr>
<td>Always Understood</td>
<td>69.886</td>
<td>73.263</td>
<td>0.708</td>
</tr>
<tr>
<td>Always Participates in Conversations</td>
<td>78.133</td>
<td>74.324</td>
<td>0.721</td>
</tr>
<tr>
<td>Always Starts Conversations</td>
<td>72.784</td>
<td>73.456</td>
<td>0.937</td>
</tr>
</tbody>
</table>
Results

Participant Satisfaction Questionnaire

• How do you feel about participating in sessions over the computer?
  • Comfortable (n=3) Very Comfortable (n=5)
• Did you feel you had the therapists full attention?
  • Completely (n=8)
• How easy was it to keep your attention focused on tasks and the therapist?
  • Easy (n=3) Very Easy (n=5)
• How would you prefer to receive therapy in the future if you need it?
  • Over the Computer (n=4) Undecided (n=4)
• Overall, how satisfied are you with the quality of speech therapy provided over the computer?
  • Very Satisfied (n=7) Somewhat Satisfied (n=1)
Challenges

• Experienced difficulty with the installation of the MOVI system.
• The participants Internet connectivity varied in the amount of broadband available for participation in the program.
• Occasional video quality issues in the form of pixilation and freezes.
• Sound quality issues in the form of delays and echo’s.
• The Companion software had occasional glitches we were unable to explain.
• Two of the participants had limited to no experience with personal computers and the internet.
• Inappropriate back lighting was a recurring issue with one participant.
Lessons Learned

• The MOVI desktop videoconferencing software allowed for a protected telepresence video/audio communication that was effective.
• Overall the participants felt the system was easy to use.
• Participants need to be familiar, as well as comfortable with a few computer basics before the initiation of the program.
• The online format achieved positive treatment outcomes on acoustic and perceptual measures.
• Participant satisfaction was at an extremely high level.
• The LSVT Companion software increased participant accountability and provided objective feedback for home exercises.
Thoughts for the Future
Summary

• The telerehabilitation system employed in this project was effective for the assessment and treatment of individuals with PD.
• The secure videoconferencing system was able to provide access to speech services for PD individuals in their home environment, therefore decreasing potential barriers for needed treatment.
• A basic level of participant computer literacy is helpful.
• The LSVT Companion software proved extremely helpful in delivery of the program.
Questions
Acknowledgements

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  • Alexa Barwick, Graduate Student
  • Cristina Garcia, Graduate Student
  • Laura Paiewonsky, Graduate Student
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www.uncg.edu/hhp/telerehabilitation
References

References