Telepractice for Cochlear Implants

Michelle L. Hughes, Ph.D., CCC-A
Sara N. Robinson, M.A., CCC-SLP
Boys Town National Research Hospital

Disclosures

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  – Sara Robinson is a member of the Hearing Loss Association of America.
Learner Objectives

Following this course, learners will be able to:

• Describe the factors that underlie the need for remote clinical services for speech-perception testing and aural rehabilitation with cochlear implant recipients.

• Explain how speech-perception scores obtained remotely using direct-connect compare to those obtained in person in a south booth.

• Describe important components of adult aural rehabilitation for cochlear implant recipients.

Overview

• Background: The Big Picture

• Study 1: Speech-perception testing in CI recipients (Michelle Hughes)

• Study 2: Aural rehabilitation with adult CI recipients (Sara Robinson)
Background

• Why is telepractice needed for CI recipients?

Reason #1: Lots of visits!

Background

• Why is telepractice needed for CI recipients?

  – Audiology/Programming:
    • 6-8 visits in first year (more for kids)
    • 1-2 visits yearly thereafter
    • Additional visits for problems or upgrades

  – Speech/language/listening therapy:
    • Number of sessions depends on recipient needs & resources

  – Medical follow-up:
    • Typically just one visit prior to IS; more if complications
Background

• Why is telepractice needed for CI recipients?

Reason #2: CI centers are not on every corner!

Background

• Why is telepractice needed for CI recipients?

Reason #2: CI centers are not on every corner!
Background

• Options for those who live far from the center:
  
  – Travel a LOT
    • Costs time (missed work/school) and money
  
  – Forego or minimize services
    • Suboptimal outcomes
  
  – Telepractice!

Background

• Previous studies with CI’s: focus on remote processor mapping with adults
  
  – Ramos et al. (2009)
  – McElveen et al. (2010)
  – Wesarg et al. (2010)
  – Eikelboom et al. (2014)
  – Hughes et al. (2012)

• Outcomes: it can be done!
Background

• But what about everything else?

  – Speech perception testing
  – Troubleshooting equipment
  – Sound-field thresholds
  – Aural rehabilitation (adults)
  – Pediatric CI programming
  – Aural habilitation (children)

Background

• Our current studies are focusing on:

  – Speech perception testing – Study 1
  – Troubleshooting equipment
  – Sound-field thresholds
  – Aural rehabilitation (adults) – Study 2
  – Pediatric CI programming
  – Aural habilitation (children)
Background

- Our current studies are focusing on:
  - Speech perception testing – Study 1
  - Troubleshooting equipment
  - Sound-field thresholds
  - Aural rehabilitation (adults) – Study 2
  - Pediatric CI programming – Goehring & Hughes (2017) JSLHR
  - Aural habilitation (children)

Study 1:
Remote Speech-Perception Testing for Cochlear Implant Recipients

Michelle L. Hughes, Ph.D., CCC-A
Joshua Sevier, Au.D.
Sangsook Choi, Ph.D.
Daniel Valente, Ph.D.
Introduction

• *Hughes et al. (2012) JSLHR* – First comprehensive study on telepractice with CIs

• Remote vs. in-person outcomes for a battery of measures:
  – Electrode impedance
  – Map levels (T & C/M)
  – ECAP thresholds
  – Psychophysical thresholds (3IFC, research software)
  – Speech perception
Introduction

- *Hughes et al. (2012) JSLHR*
- Methods for speech-perception testing:
  - 29 CI recipients (adults & older kids)
  - 3 visits, ABA design (A: in-person in booth, B: remote in room)
  - 2 sets of measures at each visit

![Diagram of experimental setup]

Introduction

- *Hughes et al. (2012) JSLHR*
- Polycom system with visual concert:
  - Two-way audio/video
  - Transmits recorded speech stimuli from tester’s computer to recipient/remote site

![Polycom system image]
Introduction

- Hughes et al. (2012) JSLHR

- Speech-perception outcome measures:
  - CNCs (words & phonemes)
  - HINT sentences in quiet
  - BKB-SIN (SNR for 50% correct)
Introduction

- Hughes et al. (2012) JSLHR
- Results:
  - Remote (visit 2) poorer
  - 14% worse for words, 10% worse for phonemes

![CNC Words and CNC Phonemes Graph]

Introduction

- Hughes et al. (2012) JSLHR
- Results:
  - Remote (visit 2) poorer
  - 19% worse for HINT, 3.1 dB worse for BKB-SIN

![HINT (Quiet) and BKB-SIN Graph]
Introduction

• Delivery of speech testing materials via videoconferencing yields reduced scores
  – Acoustic environments differ (booth vs. room)
  – Background noise, reverberation
  – Possible compression/distortion of signal being sent over the internet (Goehring et al. 2012, JSLHR)

Introduction

• Alternatives to sound-booth testing for remote service delivery:
  – Direct-connect (DAI)
  – Develop correction factors for combinations of noise/reverberation times
Introduction

- Alternatives to sound-booth testing for remote service delivery:
  - Direct-connect (DAI)
  - Develop correction factors for combinations of noise/reverberation times

Introduction

- Can direct audio input (DAI) be used for telepractice as a reasonable alternative to sound-booth speech-perception testing?
Introduction

- Booth has better acoustical characteristics than a quiet room

- Reverberation: T30 is time for signal to decay by 30 dB

Hughes et al. (2012) JSLHR

Introduction

- Reverberation results in substantial decrements in speech understanding (Kokkinakis et al. 2011)
  - 30% decrement in speech understanding for $T_{60} = 0.3$ sec

- But DAI might more closely resemble an anechoic setting

Hughes et al. (2012) JSLHR
Introduction

• Hypothesis:
  – Scores for remote DAI will not differ significantly from scores for in-person testing in the booth
  
  – Alternatively, it is possible that DAI could produce superior results due to elimination of reverberation.

Methods

• Split-half study design
  
  – Half of subjects tested remote DAI first, then in person
  – Other half tested in person first, then DAI
  – Groups randomly assigned
Methods

• Participants
  – Goal: 32 adult/teen CI recipients
  – Currently: 18 CI recipients (16 AB, 2 Cochlear)
  – Proficient in spoken English
  – At least 6 months CI use
  – Testing in monaural condition (if bilateral users)

Methods

• Stimuli
  – CNC (words, phonemes)
    • 50 & 60 dB SPL
    • Quiet
  – HINT, AzBio sentences
    • 50 & 60 dB SPL
    • Quiet, +10, and +5 SNR
  – Noise was 4-talker babble
Methods

• Stimuli – presented via ListPlayer (Advanced Bionics)

Methods

• Calibration: Advanced Bionics devices
  – Calibration for Harmony is incorporated into the ListPlayer software
Methods

• Calibration: Cochlear devices
  – Initial complications with earlier technology
  – N6 has internal SLMs
  – Calibration with proprietary software from Cochlear *(de Graaff et al. 2016)*, and ListPlayer software as input stimulus

• Procedure
  – Everyday map loaded onto lab processor
    • Harmony* for Advanced Bionics
    • CP910 (“N6”) for Cochlear
  – For DAI, setting is Aux Only
    • Cochlear automatically switches to DAI
    • Advanced Bionics requires manual switch to Aux Only program
  – All other front-end processing intact
  – No change in volume within experiment

*Excludes front-end processing not back-compatible from Naida*
Methods

• Procedure for in-person sound-booth presentation:
  – Calibration tone from ListPlayer to zero VU meter
  – SLM to calibrate to 60 dB in soundfield

Methods

• Procedure for remote DAI presentation
  – Remote location was within same building
  – Experimenter remotely controls laptop → USB sound card → programming cable → processor
  – Speech materials on computer at recipient site to avoid potential compression/bandwidth issues
Methods

• Procedure for remote DAI presentation
  – Advanced Bionics: choose “direct connect”
  – Cochlear: choose “free field”

Methods

• Analysis
  – RM ANOVA
  – Factors for CNC:
    • Location (Remote, In Person)
    • Level (50, 60 dB) – to assess Location x Level interaction
  – Factors for HINT and AzBio:
    • Location (Remote, In Person)
    • Level (50, 60 dB)
    • SNR (Quiet, +10, +5)
    • Interactions with location
Results: CNC Words & Phonemes

- Location, NS
- Level, \( p < 0.05^* \)
  - \( 60\, \text{dB} > 50\, \text{dB} \)
- Loc \( \times \) Lev, \( p < 0.03^* \)
  - Larger level differences for remote DAI

<table>
<thead>
<tr>
<th>Cond.</th>
<th>Remote</th>
<th>In-Person</th>
</tr>
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<tbody>
<tr>
<td>W50</td>
<td>62.5%</td>
<td>66.2%</td>
</tr>
<tr>
<td>W60</td>
<td>71.6%</td>
<td>65.3%</td>
</tr>
<tr>
<td>Ph50</td>
<td>77.7%</td>
<td>80.6%</td>
</tr>
<tr>
<td>Ph60</td>
<td>83.5%</td>
<td>80.2%</td>
</tr>
</tbody>
</table>

(Thornton & Raffen, 1978)

Results: HINT Sentences

- Location, NS
- Level, NS
- SNR, \( p < 0.001^* \)
  - \( 0 > +10 > +5 \)
- Location interactions NS

<table>
<thead>
<tr>
<th>Cond.</th>
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<tbody>
<tr>
<td>50Q</td>
<td>88.6%</td>
<td>88.8%</td>
</tr>
<tr>
<td>50+10</td>
<td>63.4%</td>
<td>56.6%</td>
</tr>
<tr>
<td>50+5</td>
<td>36.6%</td>
<td>31.2%</td>
</tr>
<tr>
<td>60Q</td>
<td>93.0%</td>
<td>90.1%</td>
</tr>
<tr>
<td>60+10</td>
<td>61.0%</td>
<td>55.0%</td>
</tr>
<tr>
<td>60+5</td>
<td>33.5%</td>
<td>25.9%</td>
</tr>
</tbody>
</table>
Results: AzBio Sentences

- Location, NS
- Level, NS
- SNR, $p < 0.001^*$
  - Q > +10 > +5
- Location interactions NS

<table>
<thead>
<tr>
<th>Cond.</th>
<th>Remote</th>
<th>In-Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>50Q</td>
<td>81.8%</td>
<td>83.8%</td>
</tr>
<tr>
<td>50+10</td>
<td>58.5%</td>
<td>55.0%</td>
</tr>
<tr>
<td>50+5</td>
<td>35.7%</td>
<td>28.1%</td>
</tr>
<tr>
<td>60Q</td>
<td>84.7%</td>
<td>83.7%</td>
</tr>
<tr>
<td>60+10</td>
<td>58.9%</td>
<td>56.0%</td>
</tr>
<tr>
<td>60+5</td>
<td>31.3%</td>
<td>26.8%</td>
</tr>
</tbody>
</table>

(Spahr et al. 2012)

Discussion

- Scores not significantly different between traditional in-person testing in a sound booth vs. remotely via DAI.

- Results suggest remote speech-perception testing is feasible.
Discussion

• No significant effects of level for sentences (60 dB vs. 50 dB), in contrast to Firszt et al. (2004).

• However, front-end processing in today’s technology incorporates adaptive processing that was not present then.

Challenges

• Calibration
  – Internal SLMs in processors & access is critical

• Commercial availability of necessary tools

• Communication with recipient when in DAI mode
  – No “talkover” button in ListPlayer software
Challenges

- DAI does not assess microphone functionality
- No binaural/bimodal testing

References

de Graaff F, Huysemans E, Qazi OR, Vampoucke FJ et al. (2016). The development of remote speech recognition tests for adult cochlear implant users: The effect of presentation mode of the noise and a reliable method to deliver sound in home environments. Audiol Neurotol, 21 (Suppl. 1), 48-54.
Coming up next...

Study 2: Aural Rehabilitation with Adult Cochlear Implant Recipients

Sara N. Robinson, M.A., CCC-SLP
Michelle L. Hughes, Ph.D., CCC-A
Sue A. Erdman, Ph.D., CCC-A

Aural Rehabilitation Studies

- There is a shortage of audiologists and SLPs working with cochlear implant recipients in aural rehabilitation (AR)
- Also a shortage of well controlled scientific studies examining AR services delivered via telepractice for adults with CIs
Existing Studies: AR

- Cullington, H., et. al. (2016). Have cochlear implant, won’t have to travel: Introducing telemedicine to people using cochlear implants, AJA, 25, 299-302.
  - Describes a planned project, results are not yet available
  - Remote care includes self-monitoring (online speech in noise test), self-adjustment of the device, and online support (includes equipment information, troubleshooting, goal setting, rehabilitation, help with music and telephone)
  - Remote care is not individually tailored to the recipient and is not clinician directed

Existing Studies: AR

  - Examined the use of an online training program with a virtual coach
  - Participants were hearing aid users
  - Pre-set curriculum, not tailored to individual user needs
  - Small sample size (pilot study) of 4 participants
Existing Studies: AR

• Studies on the benefit of AR and auditory training (AT) for adult HA recipients:
  – Casserly & Barney, 2017; Barcroft, et. al., 2016; Smith et. al., 2016; Tye-Murray et. al., 2016

• Studies on CI recipients mainly focus on the use of auditory training
  – Miller, Zhang & Nelson, 2016; Shafiro, et. al., 2015; Zhang, et. al., 2014

Study 2: Adult Aural Rehabilitation

• Ideally, adult AR services for CI recipients should consist of both auditory training and counseling/coaching.

• The missing link: patient centered care (PCC)
  – Addresses the whole person by eliciting narratives, engaging them in shared decision making and ensuring self-efficacy.
Study 2: Adult Aural Rehabilitation

• The primary goal of this study is to determine if clinician-directed AR conducted via telepractice is as effective as that conducted in the traditional in-person condition and superior to self-administered AT.

Study 2: Adult Aural Rehabilitation

• 4 study groups:
  – Group A: traditional clinician-directed, in-person therapy
  – Group B: clinician-directed, remote therapy
  – Group C: self-directed therapy at home
  – Control group: receives no therapy
Study 2: Adult Aural Rehabilitation

- Question 1: Are the in-person (Group A) and remote (Group B) conditions similar?
  - Hypothesis 1: Test scores will improve following intervention for all groups, and the differences between pre- and post-intervention scores will be statistically equivalent for Groups A and B.
- Question 2: Is clinician-directed therapy (Groups A & B) superior to self-directed therapy (Group C)?
  - Hypothesis 2: Groups A and B will demonstrate significantly more improvement than group C because both involve a comprehensive approach that is facilitated by a clinician.

Methods

- Enrollment Criteria:
  - Post lingually deafened
  - Native English speaker
  - Oral communicator
  - Groups matched on duration of CI use, duration of deafness, baseline performance level (CNC words)
  - Score of 18-30 on cognitive screening test: Montreal Cognitive Assessment (MoCA)
    - 26-30 is passing
    - 18-25 possible mild cognitive impairment
Methods

- Experimental design:
  - 4 groups (16 subjects per group):
    - Group A: In-person, clinician-directed therapy
    - Group B: Remote, clinician-directed therapy
    - Group C: At-home, self-directed therapy
    - Control Group: Receives test visits only, no therapy
  - Pre-test phase, intervention, post-test phase

- Subject demographics

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<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>65.69</td>
<td>8.21</td>
<td>9.75</td>
<td>64%</td>
<td>25.44</td>
</tr>
<tr>
<td>Group B</td>
<td>60.94</td>
<td>7.53</td>
<td>8.81</td>
<td>62%</td>
<td>25.81</td>
</tr>
<tr>
<td>Group C</td>
<td>64.56</td>
<td>7.37</td>
<td>8.93</td>
<td>63%</td>
<td>27</td>
</tr>
</tbody>
</table>

- No significant difference between any of the groups on these categories
Methods

- Pre- and post-test measures:
  - Nijmegen Cochlear Implant Questionnaire (NCIQ)
    - Designed specifically for CI recipients
    - 60 questions, 3 domains (physical, psychological, social)
  - Communication Profile for the Hearing Impaired (CPHI)
    - 4 areas related to coping
    - 163 questions, rated 1 (substantial problem) to 5 (no issues)
Methods

• Pre- and post-test measures:
  
  – Testing portion of Angel Sound™ software
    • Free auditory training tool
      http://angelsound.emilysfoundation.org/
    • Testing and training portions
    • Environmental Sounds, Vowel Recognition, Consonant Recognition, Word Discrimination, Everyday Sentences, Music Instruments, Music Melody
  
  – Speech perception
    • CNC words
    • AzBio sentences
    • BKB-SIN

Methods

• Intervention

  Group A (In Person)  Group B (Remote)  Group C (At Home)

  • 30 minutes: counseling/coaching
  • 30 minutes: Angel Sound™ training
  • 30 minutes: counseling/coaching
  • 30 minutes: Angel Sound™ training
  • 30 minutes: AR reading resources
  • 30 minutes: Angel Sound™ training
Methods

- Remote set-up uses a Polycom system with the participant and clinician in separate rooms.

Methods

- Scripted patient-centered counseling process

  - Elicit a narrative from the CI recipient
  - Empathize and validate patient’s experience
  - Shared decision making, summarize challenging situations as goals
  - Provide instruction on selected topics
  - Promote self-efficacy, successful self-management
## Methods

<table>
<thead>
<tr>
<th>Aural Rehabilitation Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Understanding Hearing Loss</td>
</tr>
<tr>
<td>2. Hearing Loss and Emotions</td>
</tr>
<tr>
<td>3. Listening in Noise</td>
</tr>
<tr>
<td>4. Communication Strategies</td>
</tr>
<tr>
<td>5. Using the Telephone</td>
</tr>
<tr>
<td>6. How do CI's and HA's Work?</td>
</tr>
<tr>
<td>7. Listening to Music</td>
</tr>
<tr>
<td>8. Workplace Challenges</td>
</tr>
<tr>
<td>9. Lip Reading</td>
</tr>
<tr>
<td>10. Listening Strategies</td>
</tr>
<tr>
<td>11. Communication Tips for Families</td>
</tr>
<tr>
<td>12. Assertiveness</td>
</tr>
<tr>
<td>13. Environmental Considerations</td>
</tr>
<tr>
<td>14. Assistive Listening Devices</td>
</tr>
<tr>
<td>15. Tinnitus</td>
</tr>
<tr>
<td>16. Inspirational Stories</td>
</tr>
</tbody>
</table>

**Methods**

- **Intervention:**
  - Auditory training with Angel Sound Basic Module
    - Environmental sounds
    - Music
    - Vowels
    - Consonants
    - Words
    - Sentences
Example of Remote Session

Example of In-Person Session
Example of Auditory Training

Results

• Results to date:
  – 48 participants completed (4 in progress)
    • N=16 Group A
    • N=16 Group B
    • N=16 Group C
    • N=4 Control Group (in progress)
## Results

### Angel Sound

| Subtest               | Baseline – Post | Group Effect?
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Environmental Sounds</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Instrument Recognition</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Melody Recognition</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Vowels</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Consonants</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Word Discrimination</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Sentences</td>
<td>*</td>
<td>A=B=C</td>
</tr>
</tbody>
</table>

* indicates significant improvement, = indicates no significant difference

A = In Person  B = Remote  C = At Home

### Speech Perception

| Subtest         | Baseline – Post | Group Effect?
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>CNC-Words</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>CNC-Phonemes</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>AzBios</td>
<td>*</td>
<td>A=B=C</td>
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<tr>
<td>BKB-SIN</td>
<td>B=P</td>
<td>A=B=C</td>
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</table>

* indicates significant improvement, = indicates no significant difference
## Results

- **NCIQ**

<table>
<thead>
<tr>
<th></th>
<th>Baseline – Post</th>
<th>Group Effects</th>
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<tbody>
<tr>
<td>Basic Sound Perception</td>
<td>B=P</td>
<td>A=B=C</td>
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<tr>
<td>Advanced Sound Perception</td>
<td>*</td>
<td>A=B=C</td>
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<tr>
<td>Speech Production</td>
<td>B=P</td>
<td>A=B=C</td>
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<tr>
<td>Self-Esteem</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Activity Limitations</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Social Interactions</td>
<td>B=P</td>
<td>A=B=C</td>
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</table>

* indicates significant improvement, = indicates no significant difference

- **CPHI Communication Performance**

<table>
<thead>
<tr>
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<th>Baseline – Post</th>
<th>Group Effects?</th>
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<tbody>
<tr>
<td>Social</td>
<td>B=P</td>
<td>* B &gt; A,C</td>
</tr>
<tr>
<td>Work</td>
<td>B=P</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Home</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Social Importance</td>
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</tr>
<tr>
<td>Home Importance</td>
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<tr>
<td>Average</td>
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<td>* B &gt; A,C</td>
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<td>* B &gt; A,C</td>
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<td>Problem Awareness</td>
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* indicates significant improvement, = indicates no significant difference
## Results

### CPHI Communication Environment

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<td>Attitudes of Others</td>
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<tr>
<td>Behaviors of Others</td>
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## Results

### CPHI Communication Strategies

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<tr>
<td>Nonverbal Strategies</td>
<td>*</td>
<td>A=B=C</td>
</tr>
</tbody>
</table>

* indicates significant improvement, = indicates no significant difference
Results

- CPHI Personal Adjustment

<table>
<thead>
<tr>
<th></th>
<th>Baseline – Post</th>
<th>Group Effects?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Acceptance</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Acceptance of Loss</td>
<td>B=P</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Anger</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Displacement of Responsibility</td>
<td>B=P</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Exaggeration of Responsibility</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Discouragement</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Stress</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>*</td>
<td>A=B=C</td>
</tr>
<tr>
<td>Denial</td>
<td>*</td>
<td>A=B=C</td>
</tr>
</tbody>
</table>

* indicates significant improvement, = indicates no significant difference

Discussion

- Overall, each group (A, B, C) demonstrated improvement on most measures (supports hypothesis 1)
- Group A was equivalent to Group B for most measures (supports hypothesis 1)
- Overall there was no significant difference between the groups (A=B=C) (did not support hypothesis 2)
Discussion

- Group C may have demonstrated more improvement than expected due to the higher motivation of being paid to participate in a research study
- Group C also spent time reading AR resources, which is not typically part of standard care (i.e. not included in computer-based AT programs)
- Some participants in Group C spent more time on Angel Sound than instructed

Feedback From Subjects

- What did you like the most about the way you received your therapy?

<table>
<thead>
<tr>
<th>In-Person (A)</th>
<th>Remote (B)</th>
<th>At-Home (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The opportunity to interact.</td>
<td>The way she listened and seemed to really care about my needs.</td>
<td>Liked the flexibility of the at-home program.</td>
</tr>
<tr>
<td>I liked doing it with a person as it was scheduled and not easy to miss.</td>
<td>Personable still, even though not in the same room.</td>
<td>Could be done at my convenience and comfort.</td>
</tr>
<tr>
<td>As we progressed section to section I was able to ask questions.</td>
<td>Frankly, it was as if the clinician was right there in the room with me, it didn’t present any difficulties.</td>
<td>Being able to do different computer programs at home. Could do one I felt good about when frustrated with others.</td>
</tr>
</tbody>
</table>
Feedback From Subjects

- Did participating in this study change your perceptions about aural rehabilitation?
  - It helped me better understand some of my frustrations and be able to talk about them.
  - It made me think more about actual word structures and sounds I miss.
  - I learned to be assertive.
  - I wish I would have had this training when I first received my cochlear implant!
  - I’d never heard of it, found it to be a “missing link” to hearing better.

References

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