Beyond Hearing Aids and Cochlear Implants: Helping Families Make the Most of Assistive Technology

Samuel R. Atcherson, Ph.D.
Assistant Professor, Clinical Audiologist, Person w/ Hearing Loss

University of Arkansas at Little Rock/
University of Arkansas for Medical Sciences

Investing in Family Support Conference 2010
Disclosure Statement

- Nothing to disclose.
- No financial arrangement with any product discussed in this presentation.
Since I grew up with hearing loss too, some things about me…

- Diagnosed at 3 ½ years
- Hearing aids for 31 years
- Cochlear implant for 9 years
- Mainstream education, but 14 different schools before HS graduation
- Active in both hearing and Deaf worlds
- Former President of the Association of Medical Professionals with Hearing Losses
What’s the Best Way to Teach Families about Assistive Technology?
Best Way?

- Handouts
- Websites
- Presentation
- Demonstration
- Hands-On

Problems?
- A lot of different technology to consider
- A lot of different scenarios to consider
- A lot of compatibility issues to consider
- What’s a personal device vs. what’s publicly available
Today’s Topics

- How Ear Works
- What Hearing Aids and Cochlear Implants Do
- Hearing Assistive Technology and Assistive Technology
How the Ear Works

- **Outer ear** – traps sound
- **Middle ear** – changes sound from air to fluid
- **Inner ear** – changes sound from fluid to electric
Inner and Outer Hair Cells

Healthy

Damaged

Inner Hair Cells
(to the Hearing nerve)

Outer Hair Cells
(makes sound LOUDER)
Problem 1 - Audibility

100 dB Range!

50 dB Range?
Problem 2 - Discrimination
Problem 3 - Localization

- Can’t tell where sound is coming from?
Problem 4 – Attention/ Fatigue

- Passive Listening

  Versus

- Active Listening
Hearing Aids
Hearing Aids

- Purpose: to amplify sounds
- Requires a good outer, middle, and inner ear
- The more severe the hearing loss, is more “muffled” speech will become
- If speech is “muffled”, strong hearing aids only make the “muffle” louder
Hearing Aids NOT Perfect

- **Cannot** amplify all high pitches well
- **Cannot** remove all background noise
- Directional microphones **don’t work well in gymnasium or cafeteria**
- Hearing aids still depend on good outer, middle, and inner ear
Hearing Aid Features Related to Assistive Technology

- Telecoils
- FM
- Direct Audio Input
- Wireless/Bluetooth
Cochlear Implants
Cochlear Implants

- 100,000+ people worldwide
- Purpose: electrically stimulate hearing nerve
- Requires good hearing nerve
- NOT brain surgery
- May help develop hearing skills
Deaf Health Fair 2008
Detroit, MI

Confusion?

Typical Hearing

Implant User

Brain

Cochlea

Frequencies (Hz)

Typical Hearing

Implant User

Confusion?

Copyright © Samuel R. Atcherson, Ph.D.
What Cochlear Implants Might Help With

- Soft sounds
- High pitch sounds
- Music appreciation
- Recognize or understand speech
- Know “where” sounds are

Paul and Sally Taylor, Deaf Couple with Cochlear Implants
Cochlear Implants NOT Perfect

- **Cannot** make hearing normal
- **Cannot** help understand music
- **Cannot** remove background noise
Cochlear Implant Features Related to Assistive Technology

- Telecoils
- FM
- Direct Audio Input
- Wireless/Bluetooth
Hearing Assistive Technology and Assistive Technology

Why Hearing Aids and Cochlear Implants May Not Be Enough!
Choosing Assistive Technology

- Consider a formal or informal needs assessment for the child/patient involving parents and teachers

- Formal Examples:
  - ALDS Checklist for Listening and Talking Problems\(^1\)
  - The Compton Assistive Technology Questionnaire\(^2\)

1 Lightfoot & Vaughn (1989) chapter; Introduction to Aural Rehabilitation (2\(^{nd}\) ed.)
2 Compton (2000) chapter; Rehabilitative Audiology: Children and Adults (3\(^{rd}\) ed.)
Important Concept

Signal-to-Noise Ratio
### Signal-to-Noise Ratio (SNR)

<table>
<thead>
<tr>
<th>Noise to Signal Ratio (SNR)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10 dB</td>
<td>Awful!</td>
</tr>
<tr>
<td>0 dB</td>
<td>Awful!</td>
</tr>
<tr>
<td>+10 dB</td>
<td>Better!</td>
</tr>
<tr>
<td>+20 dB</td>
<td>Best!</td>
</tr>
</tbody>
</table>

**Speech**

**Noise**
Noise: A Visual Example

Atcherson & Davis (2007); Davis, Atcherson, & Johnson (2007)
Reverberation: A Visual Example

DO YOU SEE ME?

DO YOU SEE ME?

DO YOU SEE ME?

DO YOU SEE ME?
Reverberation

Atcherson & Davis (2007)
Speech in Reverberation

Adapted from Hawkins (1988), In *Hearing Impairment in Children*
Speech in Reverberation and Noise

Adapted from Bess and Tharpe (1986) *Ear Hear* 7(1)
How Assistive Listening Devices Work

- **Microphone**
- **Transmitter**
- **Receiver**
Atcherson & Davis (2007); Davis, Atcherson, & Johnson (2007)

DO YOU SEE ME?

DO YOU SEE ME?

DO YOU SEE ME?
ME

FM System (circa 1980s)
FM Systems

Phonak Inspiro

Oticon Amigo
Small FM Receivers!
Assistive Technology

More choices and decisions...
Pros and Cons of Hearing Assistive Technology

- Not all work for everyone
- Everyone has different hearing aids, cochlear implants, and needs
- Motivation is the key to success
Television/ Movie Theater

- Closed Captioning (CC)
  - VHS with CC
- DVD subtitles
- Opened Captioning
  - Seen in selected movies at theaters
- Rear-Window Captioning
  - Seen in selected movies or shows
Rear-Window Captioning
Alerting/ Signaling Devices

- Vibrating alarm clocks (nighttime)
- Vibrating alarm watches
- Vibrating pagers
- Signalers (acoustic, smoke, carbon monoxide, motion, phone, etc.)
- Wasabi alarms?
Telephone Options

- Amplified Phones
- TTY/ TDD
  - User-to-user
  - User-to-relay-to-non-user
- VCO and Captel phones
- Videophone, Skype, etc.
- Cells Phones
VCO and Captel Phones

www.sprintcaptel.com – requires caption telephone
www.sprintcaptel.com – required internet connection and any phone
www.captel.com – requires caption telephone
Videophone Options

Skype – requires webcam, microphone, speakers, and internet
Cell Phones

- Major push to make all phones hearing aid compatible

- What are some issues with cell phones?

- What are other uses of cell phones?
Bluetooth Cell Phone Connectors

- Bluetooth wireless system for use with cell phones
- Requires direct audio input
- Ask your audiologist
Bluetooth Cellphone and iPod Setup: Oticon Streamer Example

http://www.myoticon.com/Streamer/Streamer1.aspx
Bluetooth/DAI/Telecoil Products

- Geemarc i-Loop and t-LOOP

http://www.geemarc.com/eng/
Amplified Stethoscopes

AblePlanet – clarity or noise cancellation phones
Visual Stethoscope

Stethographics Handheld STG
More Resources

○ Demystifying Hearing Assistance Technology: A Guide for Consumers
  ● Davis, Atcherson, and Johnson (2007)
  ● http://www.wou.edu/~davisc/Demystifying.pdf

○ www.aldtraining.com
  ● Becky Morris
THANK YOU!

sratcherson@ualr.edu