Solutions for Single-Sided Deafness

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Fall, 2011
Overview

- Candidacy Issues & Myths
- Technology thru the decades
- 2004-2005 Salem Audiology Clinic Independent Study & Case Studies
- Current Study
- Verification (with demonstration)
Candidacy Issues & Myths

• Profound SNHL in one ear to a degree that there is no perceived benefit from amplification, or if the patient is for some other reason unable to wear amplification in that ear.

• Hearing loss to such a degree that speech discrimination is less than 50% in the worse ear.

• Hearing loss asymmetry to such a degree that there is a speech discrimination differential of ~50% between ears (i.e. 96% vs. 48%).
Candidacy Issues & Myths

• Patients with Single-Sided deafness are normally underfit
  – Many hearing healthcare practitioners often just fit the better ear.
  – Many do not believe in the benefits of CROS / BiCROS technology, despite the clinical evidence which proves otherwise
  – Many are simply unaware of the options available today.
Candidacy Issues & Myths

• Consequences of Single-Sided Deafness (*and* underfitting it!)
  – Missing half the conversation
  – Risk of offending people who call your name from the poor side and you ignore them
  – Greater difficulty in background noise
  – Lack of awareness of warning signals originating from the poor side
  – Turn head frequently to put the better ear towards the signal of interest
Candidacy Issues & Myths

- Benefits of appropriate treatment
  - Greater ability to obtain the entire conversation (improvement in speech discrimination)
  - Responding appropriately when your name is called
  - Improved hearing in background noise
  - Greater localization of sound direction
  - Keeping your head straight for the conversation
Underfit Example

- Contacted by Vocation Rehabilitation
  - They requested my review of an audiogram by another audiologist regarding verification of benefit
  - The audiologist involved said that the audiogram indicated benefit, but the VR counselor could not find it.
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Underfit Example

• The audiologist’s notes:
  – Lasted evaluated on 5-28-1979
  – Current hearing aid (fit monaural) defunct
  – Speech discrimination for the right ear, aided was 60%, MCL 90dBHL, 92% aided.
  – Recommendation for monaural fitting with Phonak Naida V SP
  – No mention of whether or not CROS technology was discussed
Definition of Amplification Types

• CROS
  – The better ear is ear normal or near normal.
  – Direction amplification to the better ear unnecessary for good speech discrimination.

• BiCROS
  – The better ear has hearing loss.
  – As a result, direction amplification is necessary for good speech discrimination as well as receiving transmission from the offside mic.
Candidacy Issues & Myths

Is this a CROS or BiCROS candidate?

Discrim: 100% 0%
Candidacy Issues & Myths

Is this a CROS or BiCROS candidate?

Discrim: 60% 0%
Candidacy Issues & Myths

Is this a CROS or BiCROS candidate?

Discrim: 24% 80%
Candidacy Issues & Myths

Is this a CROS or BiCROS candidate?

Discrim: 100%  84%
Technology thru the decades

the old stuff

- Wired CROS systems
- Trans-Cranial CROS
- The Original Wireless: “Telex” CROS
Technology thru the decades
21st Century

• Telex Closure (2004)
  – Phonak CROSLink
  – Unitron WiFi
  – Interton IQ

• TransEar

• Bone-Anchored Hearing Aids (BAHA)
Technology thru the decades

21st Century

Unitron WiFi CROS

- Can be matched only to Unitron BTEs
- Offers great variety for fine-tuning and technology level
- Small, compact cases in comparison to Telex or CROSLink
- Limited in that it only works with Unitron
- At first, no T-coil, so limited with ALDs, but later added a switch to the bottom of the receiver. Works, but broke easy (flimsy).
- Directionality limited to monaural (non-CROS) setting; no bilateral hearing in noise.
- Interference issues
- Briefly attempted ITEs
- Discontinued 2010
Technology thru the decades

21st Century

Phonak CROSLink Universal System

- Can be matched to any MicroLink compatible BTE – Basically all manufacturers if aids had DAI.
- Offers great variety for fine-tuning and technology level
- Bulky case design; need competent patient for manipulation of Shoe design; issues with battery replacement.
- If aid has T-Coil, still usable with ALDs
- Could be set to BiCROS & directional at the same time, but only aided side would be directional
- Interference issues
- Universal means greater lifespan
- Still available?
Technology thru the decades
21st Century

Interton IQ Wireless CROS

- BTE & ITE
  - High-end instrument
  - Integrated case for both ITEs and BTEs
- No T-Coil
- Still available?
2004-2005 Salem Audiology Clinic CROS Study

Participants:

- 34 individuals, ages 38-82
- Most with Single-Sided Deafness “SSD”, some with special situations
- Most previous users
Methodology:

• Trial period of 2 weeks with each of three ear-level, new CROS system introduced in 2004
• Each instrument fit according to manufacturer “Quick-Fit” at initial fitting; normal adjustments at follow-up.
• Visible Speech Mapping for Verification Measures
• QuickSIN Evaluation
• Subjective Survey
Visible Speech Mapping Procedure for CROS

- Place probe mic in better ear
- 1st Run: VSM Unaided
- 2nd Run: VSM Monaural \((\text{better ear only})\)
- 3rd Run: VSM Binaural \((\text{CROS Activated})\)
Visible Speech Mapping Results

- All BiCROS subjects showed substantial improvement for VSM in the better ear
- All CROS subjects showed mild improvement for VSM in the better ear
- VSM utilizing Recorded speech showed better results than utilizing the standardized speech signal
2004-2005 Salem Audiology Clinic CROS Study

QuickSIN Evaluations

- 1st Run Unaided
- 2nd Run Aided, Monaural
- 3rd Run Aided, Binaural
- 4th Run Aided, Binaural w/Directional if available
Results:

Rush Limbaugh

- Interton system picked up Salem 1430 AM—conservative talk radio
- Consistent for first 9 patients
- Interton Solution: set up “monaural program”
- Results: patients disliked
- Interton dropped from study
2004-2005 Salem Audiology Clinic CROS Study

Case Study: Linda, age 38

- New User
- Preferred Unitron system because of size of instrument
- Monaural Discrim: 100%
- Binaural Discrim: 100%
- QuickSIN Unaided: 8.5dB SNR Loss
- QuickSIN w/CROS: 2.5dB SNR Loss
2004-2005 Salem Audiology Clinic CROS Study

Case Study: Dave, age 78

-- “Power BiCROS”

- Previously Phonak PowerZoom w/Remote
- Preferred Phonak system because of remote
- Monaural Discrim: 60%
- Binaural Discrim: 72%
- QuickSIN Aid Only, directional: 11.5dB SNR Loss
- QuickSIN w/CROS: 8.0dB SNR Loss
Case Study: Craig, age 56
– “High Frequency BiCROS”
• New User
• Preferred Unitron system because of size
• Monaural Discrim: 100%
• Binaural Discrim: 100%
• QuickSIN Unaided: 7.5dB SNR Loss
• QuickSIN w/CROS: 4.5dB SNR Loss
Case Study: Linda, 62

--“Discrim CROS” (mild stroke)

- Wore Telex BiCROS
- Preferred Phonak system because of used T-Coil with FM system
- Monaural Discrim: 80%
- Binaural Discrim: 92%
- FM Discrim: 100%
- QuickSIN Aid Only: 22.5dB SNR Loss
- QuickSIN w/CROS, directional: 13.0dB SNR Loss
- QuickSIN FM: 7.5dB SNR Loss
2004-2005 Salem Audiology Clinic CROS Study

Results: Overall Performance *(Scored 1-10)*

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<thead>
<tr>
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<th>Phonak</th>
<th>Unitron</th>
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<tbody>
<tr>
<td>Patient Impression</td>
<td>7.9</td>
<td>9.1</td>
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<tr>
<td>Objective Impression</td>
<td>9.5</td>
<td>9.0</td>
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<tr>
<td>Overall Performance</td>
<td>8.7</td>
<td>9.0</td>
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Results: Purchases

- Of the 34 candidates, 33 purchased immediately, 1 waited
  - 27 purchased Unitron, primarily because of the physical design
  - 6 purchased Phonak due to sound quality preference, T-Coil, or remote options
  - 1 waited *until* Unitron introduced an ITE CROS system in early 2005.

- Long-term
  - Of the 6 that purchased Phonak, 4 returned within 6-12 months and switched to Unitron, mainly because of intermittency issues with the CROS audioshoe becoming loose over time, or frustration changing batteries.
  - Net result: 31 Unitron, 3 Phonak
Summary & Impressions:

• Both products were very well received for performance.
• Product preference was driven by either (1) cosmetics or (2) functionality & options.
• There was a clear distinction between those who chose cosmetics and those who chose function.
• Recommendations need to take into account many aspects beyond configuration of hearing loss:
  – Lifestyle
  – Cosmetics
  – ALDs & Remotes
Technology thru the decades

21st Century

Quasi-CROS: FM technology

- Not ear-worn; greater versatility for use in different situations
- Proven greater benefits with noise reduction, distance, and reverberation.
- Requires some sophistication
- Range of pricing
  - High-End: Phonak MicroLink
    $2,250 - $3,300
  - Mid-Range: Conversor Neckloop
    $1,000, plus aid.
TransEar From Hearing technologies

- Maker of Dry ‘n’ Store
- Trans-Cranial CROS
  - Aidable ear must have bone conduction scores of 30dBHL or better.
  - Physical transmission via bone conduction on the poor side, no instrument worn on the better ear.
  - Device consists of a BTE wired, a’la RIC, to a soft silicone solid mold that vibrates the entire ear canal.
Technology thru the decades
21st Century

TransEar From \textit{Hearing technologies}

- Issues (attempted fittings: 3)
  - Comfort issues (extremely tight fit)
  - Retention issues (tightness as well as vibration)
  - Limited fitting range based on better ear; due to necessary bone conduction scores, truly \textit{only} usable for a CROS fitting.
  - Maintenance issues: if it vibrates, it’s gonna break
21st Century

Bone-Anchored Hearing Aids (BAHA)

- Cochlear Corporation
- Also works via transcranial CROS
- Better ear requires PTA bone thresholds of 35dB or better; some surgeons push the margins and go as far as 50dB.
- Ideal candidates: those who cannot wear traditional amplification for various reasons (comfort, drainage).
Technology thru the decades

21st Century

Bone-Anchored Hearing Aids (BAHA)

- Obstacles & Issues
  - Invasive surgery
  - Cosmetics
  - Rejection Rates (15%)
  - Cost ($14k - $20k)
  - Delivery time (4-6 months)
  - Repair rates
Technology thru the decades

Current Innovations

- Unitron *Tandem*
- Phonak “*Target*” CROS
- Audifon *via*
Technology thru the decades

*Current Innovations: Tandem*

**Unitron Tandem: Improvements**

- Similar physical design to the original Unitron WiFi, but with improvements.
- Newer software platform
- Integrated T-Coil (no separate, breakable switch!)
- Remote option
- Updated, advanced features
Unitron Tandem: Issues

- Still an overall large design
- Still picks up interference
- Still cannot be directional and CROS at the same time
- Automatic does not include directional
- No low-cost option
  - Previous Unison Essential: $2,250
  - Tandem-4: $3,000
Phonak “Target” CROS: Improvements

- Miniature design options
- BlueTooth transmission \((no\; interference)\)
- BlueTooth benefits
  - Connectivity
  - Ear to Ear
- Newer software platform
- Bilateral directionality—\textit{kind of}
- Remote option
- Updated, advanced features (\textit{SoundRecover})
Technology thru the decades

Current Innovations: “Target”

Phonak “Target” CROS: Issues

• Battery Life
• No low-cost option
  – Cassia / Audeo-3: $3,100
Technology thru the decades

**Current Innovations:** “via”

**audifon via CROS:** Improvements

- Mid-range features and price
- Transmits via magnetic induction
Technology thru the decades

Current Innovations: “via”

audifen via CROS: Issues

- No directional technology
- Interference?
- Battery drain? (2.95mA)
- AAA
Technology thru the decades

**The future?**

Wireless opportunities

- Oticon ConnectLine Microphone \textit{(now)}
- ReSound?
- Starkey?
Current Study

- Currently comparing Phonak Target CROS & Unitron Tandem
- 2 week x 2 week comparison
- VSM evaluations and subjective surveys
Current Study

Preliminary Results

• 26 candidates currently enrolled
• 22 have completed trials
  – New users preferred the Phonak Audeo Smart V because of smaller design, lighter weight.
  – Previous users preferred Unitron Tandem-16 because of larger design, battery life.
• Completion date: Late September, 2011
• Extension: Patient Success Stories book
Verification: CROS transmission

Procedure: Real Ear or VSM

- Place patient at 90 degrees azimuth, with the “dead” ear facing the presentation speaker(s).
- Place the probe mic in the better ear, on the far side from the presentations speaker(s).
- Measure as follows:
  - Unaided (both sides off)
  - Aided (better ear on only)
  - Aided with CROS

- Repeat with face-to-face, 0 degrees azimuth
Verification: CROS transmission

Procedure: Sound Field

• Place patient at 90 degrees azimuth, with the “dead” ear facing the presentation speaker(s).
• Measure puretones and speech as follows:
  – Unaided (both sides off)
  – Aided (better ear on only)
  – Aided with CROS
• Repeat with face-to-face, 0 degrees azimuth
Verification: Sample #1
Verification: Sample #1

Speech Discrimination

Unaided: 88%
Verification: Sample #1

Speech Discrimination

Unaided: 88%
Aid Only: 92%
Verification: Sample #1

Speech Discrimination

Unaided: 88%
Aid Only: 92%
Aid w/CROS: 100%
Verification: Sample #1

Speech Discrimination

Unaided:  88%
Aid Only:  92%
Aid w/CROS:  100%
Verification: Sample #2
Verification: Sample #2

Speech Discrimination

Unaided: 40%
Verification: Sample #2

Speech Discrimination
Unaided: 40%
Aid Only: 72%
Verification: Sample #2

Speech Discrimination
Unaided:  40%
Aid Only:  72%
Aid w/CROS:  96%
Verification: Sample #2

Speech Discrimination

Unaided: 40%
Aid Only: 72%
Aid w/CROS: 96%
Verification: Sample #3
Verification: Sample #3

Speech Discrimination

Unaided: 0%
Verification: Sample #3

Speech Discrimination

Unaided: 0%
Aid Only: 32%
Verification: Sample #3

Speech Discrimination

- Unaided: 0%
- Aid Only: 32%
- Aid w/SR on: 44%
Verification: Sample #3

Speech Discrimination
Unaided: 0%
Aid Only: 32%
Aid w/SR on: 44%
Aid, SR, CROS: 60%
Summary:

- Pay careful attention and don’t assume that you can’t help when a patient has an “unaidable ear”; they still may have an “aidable” side.
- Keep an open mind and evaluate new technology as it arrives on the market.
- Verify, verify, verify.