Solutions for Single-Sided Deafness

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Overview

• Candidacy Issues & Myths
• Technology through the decades
• Salem Audiology Clinic
  Independent Study & Case Studies
• 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 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
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.
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.
Underfit Example

- The audiologist’s notes:
  - Lasted evaluated on 5-28-1979
  - Current hearing aid defunct (fit monaural)
  - Speech discrimination for the right ear, aided was 60%, MCL 90dBHL, 92% aided.
  - Recommendation for monaural fitting with Phonak Naida V SP (Spice)
  - 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

  - 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
- Discontinued
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
- 1\textsuperscript{st} Run: VSM Unaided
- 2\textsuperscript{nd} Run: VSM Monaural (\textit{better ear only})
- 3\textsuperscript{rd} Run: VSM Binaural (\textit{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
QuickSIN Evaluations

- 1st Run Unaided
- 2nd Run Aided, Monaural
- 3rd Run Aided, Binaural
- 4th Run Aided, Binaural w/Directional if available
2004-2005 Salem Audiology Clinic CROS Study

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
2004-2005 Salem Audiology Clinic CROS Study

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
2004-2005 Salem Audiology Clinic CROS Study

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.
Technology thru the decades

21st Century

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.
TransEar From *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 *only* usable for a CROS fitting.
  - Maintenance issues: if it vibrates, it’s gonna break
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

21\textsuperscript{st} 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

21st Century

SoundBite by Sonitus Medical

- Utilizes an ear-level microBTE as a microphone pick-up
- Transmits to a mouth-worn prosthetic which utilizes bone conduction (the teeth are very efficient for bone conduction).
- Rechargeable battery (6-8 hours for ITM, 15-18 hours for mBTE).
- Dental visit to confirm good oral health, then obtain dental impression for custom-built ITM.
Technology thru the decades
21\textsuperscript{st} Century

SoundBite by Sonitus Medical

- Obstacles and Issues
  - Puretone average for bone for better ear cannot exceed 35dB.
  - Personally, limited experience with fitting this product (3).
  - Conceptually, can be difficult for patient to accept.
  - Possibly subject to high repair rates since it utilizes bone conduction (not seen yet)

- Advantages
  - No invasive surgery required
  - More cost effective than BAHA
Technology thru the decades

Traditional Styles

- 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
Technology thru the decades

**Current Innovations: Tandem**

**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
Technology thru the decades

Current Innovations: “Target”

Phonak “Target” CROS: Improvements

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

Current Innovations: “Target”

Phonak “Target” CROS: Issues

• Battery Life
  – 312, ~3 days (Dec. 2011)
  – 13, ~5-6 days (June, 2012)
  – Upgrade option

• No low-cost option
  – Cassia / Audeo-3: $3,200
  – Includes 240 batteries
Technology thru the decades

Current Innovations: “via”

audifen via CROS

- Mid-range features
- ITE or BTE
- High-end price ($4,350)
- Transmits via magnetic induction
- No directional technology
- Interference?
- Battery drain? (2.95mA)
Technology thru the decades

The future?

Wireless opportunities

- Oticon ConnectLine Microphone \((\text{now})\)
- ReSound MiniMic
- Starkey?
- Others?
Latest Study

• Comparison Study
  – Phonak Target CROS
  – Unitron Tandem
  – Audifon via (not included)
• 2 week x 2 week comparison
• VSM evaluations and subjective surveys
Latest Study

Results (*study completed September 2011*)

- 26 candidates currently completed trials
  - 11 out of 12 New users preferred the Phonak Audeo Smart V because of *smaller* design, lighter weight.
  - 10 of 14 Previous users preferred Unitron Tandem-16 because of *larger* design, battery life.
  - After study completed, one who chose Unitron came back and switch to Phonak, primarily because of the introduction of their H2O water resistant model, not based on CROS performance.
  - *Overall, 16 out of 26 patients preferred Phonak over Unitron (62%)*

- 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.