Beyond the Audiogram

Clinical Decision-Making for
Single-Sided Deafness and Asymmetric Hearing Loss in Adults

Raquel Proctor, AuD, CCC-A

KY Hearing Clinic
Kentucky Academy of Audiology Conference 2026

Disclosures

No relevant **financial** or **nonfinancial** relationships to disclose.

This presentation discusses options from multiple manufacturers. No manufacturer has influenced the content or recommendations.

Presenter Background

Raquel Proctor, AuD, CCC-A

KY Hearing Clinic, Louisville, KY

- Cochlear implant & Bone-anchored implant care
- Hearing aid technology
- Tinnitus management

Learning Objectives

01 Identify clinical challenges and patient-specific factors beyond traditional audiometric measures.

02 Critically evaluate intervention benefits, limitations, and trade-offs using current research evidence.

03 Apply an evidence-based, shared decision-making framework to assessment, counseling, selection, and outcomes.

An Expanding Candidacy Landscape

Manufacturer	U.S. SSD / AHL indication	Key criteria from available labeling
MED-EL	SSD and AHL	Poorer-ear PTA ≥90 dB HL; Better ear: ≤55 dB HL Aided CNC ≤5% in implanted ear
Cochlear	SSD / UHL	Poorer-ear PTA >80 dB HL; better ear ≤30 dB HL Aided CNC ≤5% in implanted ear
Advanced Bionics	SSD and AHL	Poorer-ear PTA ≥80 dB HL; Better ear: ≤65 dB HL Aided CNC ≤20% in implanted ear

Decisions, Decisions…

More options require more individualized decisions.

Expanding cochlear implant candidacy

Advances in hearing aids, CROS and bone conduction

Increasing SSD/AHL outcome evidence

More opportunities for individualized care

Clinical Considerations in SSD and AHL

Listening function	Patient experience	Hearing history
Speech understanding in noise	Tinnitus and quality of life	Etiology, onset, and duration
Localization and spatial hearing	Communication participation	Expectations and adaptation
Listening effort and fatigue	Adjustment to hearing loss	The better ear as a reference

What the Audiogram/Candidacy Tells Us

Hearing sensitivity

Degree, configuration and asymmetry
Word recognition

The patient conversation

Daily communication difficulties
Priorities, expectations and treatment goals

57.4%

of SSD patients selecting CI proceeded to implantation

Asfour et al., 2025

What Influences Patient Decisions?

Communication needs

Daily function, relationships and participation

Expected benefit

Meaningful change in real listening situations

Values and identity

Appearance, stigma and technology preferences

Information and guidance

Clear options and trustworthy clinical advice

Risks and barriers

Surgery, comfort, cost and access to care

Reassessment

Experiences and priorities change over time

Decision-making is individualized and ongoing.

Underdown & Pryce, 2022

Candidacy Is Only the Beginning

Candidacy

Can the patient receive this intervention?

Audiometric criteria
Medical considerations
Device indications

Clinical decision-making

Which option fits this patient's goals?

Research evidence
Clinical expertise and findings
Patient goals and informed preferences

Candidacy establishes the options. Shared decision-making guides the choice.

Boisvert et al., 2017

Four Guiding Questions

01 What are this patient’s priorities?

02 What benefits, limitations and trade-offs does each option offer?

03 How can we support an informed decision?

04 How will we evaluate whether the patient’s goals were achieved?

The Intervention Landscape

Use residual hearing	Conventional amplification AmpCROS program (Phonak, Signia)
Stimulate the poorer side	Cochlear Implantation
Route	CROS and BiCROS Bone conduction systems
Monitor	No intervention / active monitoring

Different mechanisms address different auditory needs.

Dillon et al., 2022; Peters et al., 2021

No Intervention: An Informed Decision

01 Patient preference and readiness

02 Communication strategies and counseling

03 Monitoring hearing and functional needs

04 Reconsideration as circumstances change

05 Medical considerations when delaying intervention

Deferring technology still requires a care plan.

Dillon et al., 2022; Asfour et al., 2025

When Is Poorer-Ear Amplification Appropriate?

Greater asymmetry was associated with poorer binaural speech perception.

This does not mean avoiding bilateral amplification.

Usable residual hearing

Aided speech understanding

Audibility versus clarity

Binaural benefit or interference

Verified fitting and functional outcomes

CI evaluation when appropriate

Hoppe et al., 2022

Conventional Amplification and AmpCROS

Conventional amplification

Uses residual hearing

May provide useful bilateral input; Benefit depends on auditory function

AmpCROS

Amplification plus sound routing

Bilateral hearing aids with a “CROS/BiCROS” program or other manual programming considerations

The question is whether the poorer ear provides useful auditory information.

Potier et al., 2025; Hoppe et al., 2022

Cochlear Implantation: A Different Mechanism

Auditory input to the poorer side

Direct stimulation of the poorer-side auditory pathway; benefits with tinnitus management

Potential for bilateral auditory input

Possible speech-in-noise and localization benefits

Surgery, programming, rehabilitation and adaptation

Dillon et al., 2022

Cochlear Implantation: Speech in Noise

3–6 months

Significant speech-in-noise improvements;
Benefit across tested configurations

24 months

Comparative advantages persisted;
Significance varied by configuration and comparator

Peters et al., 2021; van Heteren et al., 2025

Cochlear Implantation: Localization

Objective localization	Improved accuracy at 24 months Better performance than CROS, BCD and no treatment
Subjective spatial hearing	Improvement after CI Some subjective improvement also occurred with CROS
Clinical interpretation	Objective tests and patient reports measure different experiences

van Heteren et al., 2024

Cochlear Implantation: Tinnitus Outcomes

CINGLE / Baseline to 24 months

23

point median THI reduction

17

point median TQ reduction

Largest sustained reduction in the CI group. Individual relief is not guaranteed.

Wendrich et al., 2024

Quality of Life and Patient-Reported Benefit

Meaningful benefit extends beyond a speech score.

Hearing-related quality of life

Perceived spatial hearing

Communication confidence and participation

Objective and subjective outcomes may differ

Peters et al., 2021; Dillon et al., 2022

Sound Awareness and Binaural Hearing

Sound awareness

Access from the poorer side

Reduced head-shadow effects
Sound remains available through the better ear

Binaural hearing

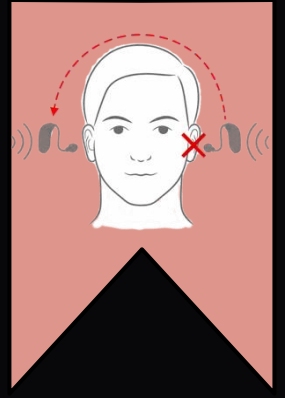
Use of input from two ears; adaptation may be prolonged

Localization and spatial hearing
Potential speech-in-noise advantages

Improved sound access alone does not establish restored binaural processing.

Dillon et al., 2022; Peters et al., 2021

CROS/BiCROS: Mechanism and Application



CROS

Routing to the better ear

For a better ear without amplification needs

BiCROS

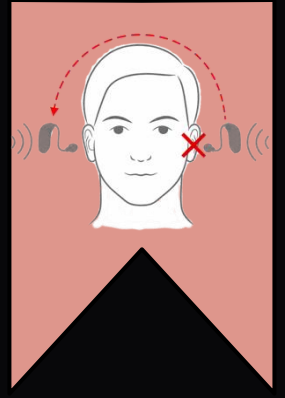
Routing plus amplification

For a better ear that also needs amplification

Both address head shadow without restoring input to the poorer ear.

Peters et al., 2021; Asfour et al., 2025

CROS/BiCROS: The Evidence



Speech at poorer ear

Noise at better ear

Benefit compared with baseline

Speech at better ear

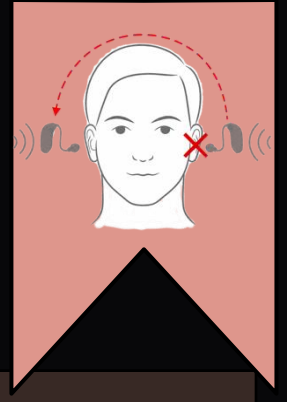
Noise at poorer ear

Performance can deteriorate

No significant objective localization improvement. Hearing-related quality of life may improve.

Peters et al., 2021

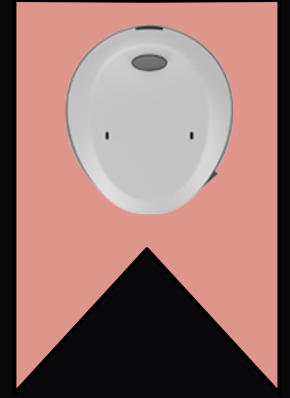
CROS/BiCROS: Clinical Trade-Offs



Benefits	Trade-offs
Access to poorer-side sound	No restoration of binaural processing
Nonsurgical	Spatially dependent speech-in-noise benefit
Easy to trial	Two-device management
Reversible	Variable perceived benefit

Peters et al., 2021; van Heteren et al., 2024

Types of Bone Conduction Systems



Percutaneous

Abutment extends through the skin

External processor generates vibrations

Examples: Baha Connect, Ponto

Active Transcutaneous

Skin remains intact; magnetic coupling

Implanted actuator generates vibrations

Examples: Osia, BONEBRIDGE

Passive Transcutaneous

Skin remains intact; magnetic coupling

Vibrations generated externally and transmitted through skin

Example: Baha Attract

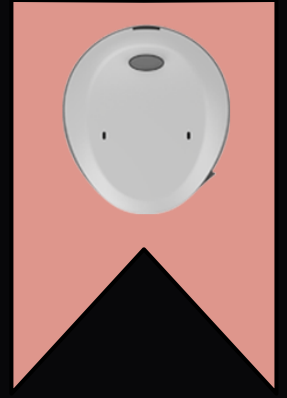
Nonimplantable

No surgery required

Vibrations transmitted through intact skin

Examples: ADHEAR, BAHA Softband

Bone Conduction: Mechanism and Application



A different pathway for sound routing

Sound transmission through skull vibration

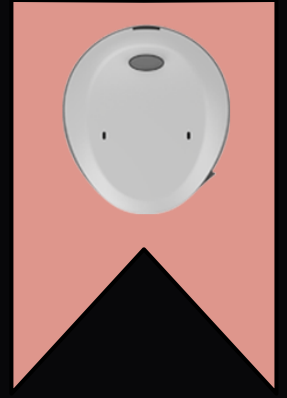
In SSD, routing toward the better-functioning cochlea

Nonsurgical demonstrations available

Implanted options require surgical consideration

Peters et al., 2021

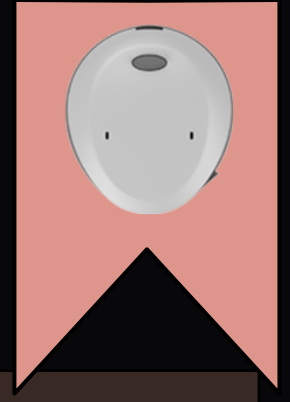
Bone Conduction: The Evidence



Speech in noise	Benefit in favorable spatial configurations Reduced performance in unfavorable configurations
Localization	No significant objective improvement in CINGLE study
Patient-reported benefit	Potential improvement in hearing-related quality of life

Peters et al., 2021

Bone Conduction: Clinical Trade-Offs



Benefits	Trade-offs
Access to poorer-side sound	No restoration of binaural hearing in SSD
Nonsurgical demonstration	Demonstration differs from implanted performance
Alternative to ear-level routing	Surgery for implanted systems
Potential communication benefit	Device-specific maintenance and retention needs

Peters et al., 2021

Comparing Interventions

Intervention	Poorer-side access	Speech in noise	Localization	Invasiveness	Trial
Conventional HAs	Depends on usable hearing	Variable	Possible with useful bilateral input	None	Easy
Cochlear implant	Direct poorer-side input	Benefit shown in SSD	Benefit shown in SSD	Surgical	No equivalent preoperative trial
CROS / BiCROS	Improved	Spatially dependent	No objective restoration in SSD	None	Easy
Bone conduction routing	Improved	Spatially dependent	Limited in SSD	System-dependent	Demonstration

Mechanism, clinical suitability and patient priorities determine the trade-offs.

Peters et al., 2021; van Heteren et al., 2025

Translating Evidence Into Expectations

01 What can improve, and what limitations will remain?

02 Under which listening conditions is benefit most likely?

03 How much individual variability should we expect?

04 Does the anticipated benefit match this patient’s goals?

Dillon et al., 2022; Peters et al., 2021

The Purpose of an SSD/AHL Evaluation

An evaluation should make the next decision clearer.

- Understand hearing experience and communication challenges
- Identify goals, priorities and expectations
- Review relevant options and trade-offs
- Select necessary assessment and develop an informed plan

Understanding the Patient Beyond the Audiogram

Hearing history

Onset, etiology and duration
Progression
Previous intervention experience

Functional experience

Daily communication difficulties
Listening environments
Lifestyle demands

Individual considerations

Adjustment to hearing loss
Impact on daily life
Motivation and readiness

Patient-Reported Measures – Use Them!

SSQ

Speech, Spatial and Qualities of Hearing Scale

Listening across speech, spatial and sound-quality domains

COSI

Client Oriented Scale of Improvement

Patient-nominated listening goals and change after rehabilitation

Baseline patient reports support goals, counseling and later outcome assessment.

Gatehouse & Noble, 2004; Dillon et al., 1997; van Heteren et al., 2024

What would meaningful improvement look like in the patient's daily life?

Highest-priority listening situations
Desired outcomes versus realistic benefit
Previous experiences and expectations
The better ear as a sound-quality reference
A concrete definition of meaningful improvement

Present options for evaluation based on available treatment options and explore alignment with patient's goals.

Purposeful Testing

01 Elicit patient feedback on available treatment options.

02 Establish candidacy or meet required evaluation criteria.

03 Inform counseling and intervention decisions.

04 Establish a meaningful baseline for outcomes.

Not every patient requires every available assessment.

Speech in Noise Testing

Has the Patient had Speech in Noise Testing?
If BAHS/CROS, Consider Aided Testing

Clinical value depends on both what we measure and how we test.

Peters et al., 2021; van Heteren et al., 2025

Intervention-Specific Evaluation

Intervention	Evaluation considerations
Hearing aids	Aidability, speech understanding and amplification benefit
CROS / BiCROS	Better-ear status, routing benefit and patient goals
Bone conduction	Audiologic and medical candidacy, trial or demonstration
Cochlear implant	Audiologic and medical candidacy, aided speech, duration and etiology
No intervention	Preference, functional needs and a monitoring plan

FDA labeling, clinical recommendations and payer requirements are distinct.

Dillon et al., 2022

Matching Capabilities to Patient Goals

Which options address what matters to this patient?

Patient priorities

Listening situations
Desired changes
Preferences and readiness

Clinical fit

Expected benefit
Limitations and trade-offs
Audiologic and medical candidacy

Counseling and Shared Decision-Making

01 Explain available options in understandable language

02 Discuss realistic benefits, limitations and trade-offs

03 Explore preferences and concerns

04 Acknowledge uncertainty and outcome variability

05 Support an informed, collaborative decision

An informed plan can include a trial, referral, intervention or monitoring.

An Individualized Clinical Plan

01	Understand the patient: hearing experience, priorities and expectations.
02	Gather purposeful information: audiology, questionnaires and targeted testing.
03	Apply the evidence: candidacy, benefits, limitations and trade-offs.
04	Develop a collaborative plan: intervention, trial, referral or monitoring.

Lucy: Patient History

50 y/o F / High school teacher

TIMELINE

August 2024	Sudden left hearing loss with true vertigo, left tinnitus, and nausea in the classroom. Initially thought it was a stomach illness or virus.
Medical workup	Primary care referred her to the ER to rule out stroke. MRI was unremarkable.
ENT treatment	Oral and intratympanic steroids at ENT; did not restore hearing.
CROS experience	She liked CROS, but it did not help left tinnitus or classroom sound localization.

PATIENT GOALS

01 Tinnitus relief

"Roaring exhaust fan" in the left ear

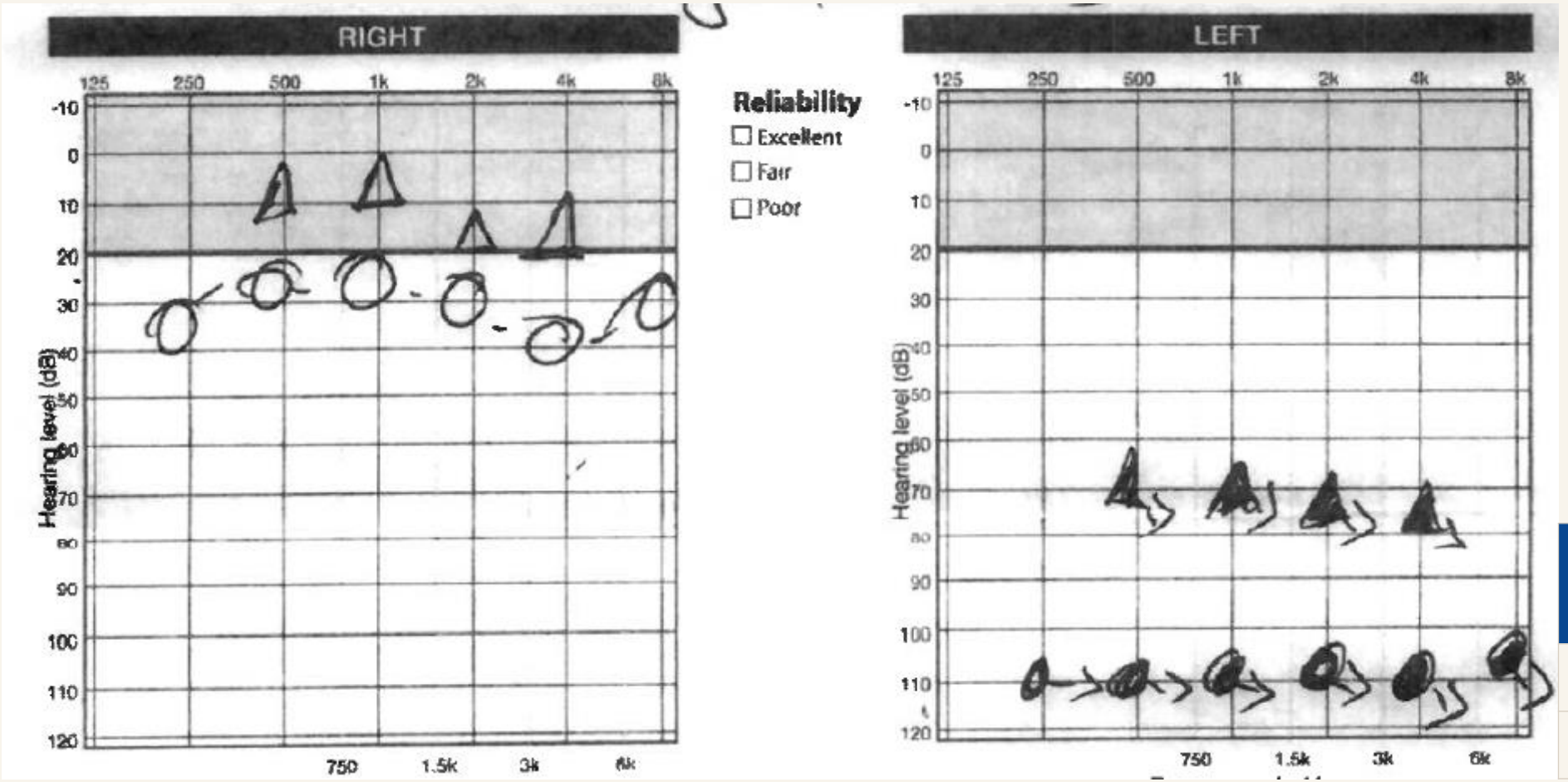
02 Sound localization

Identify which student is speaking in the science classroom

03 Hearing in noise

Hear students and filter background noise. Motivated to improve.

Audiogram



Word Discrimination Score	
Right	100%
Left	CNT

Evaluation

SUMMARY

Right ear Mild conductive hearing loss

Left ear Profound sensorineural hearing loss

AIDED SPEECH RECOGNITION

Test / condition	Score
Right CNC	100%
Left CNC, contralateral ear masked	0%
AU AzBio, +10 dB SNR	58%

PATIENT-REPORTED MEASURES

Measure	Score	Reported severity
CIQoL-10	27	(Out of 50)
THI	59	Grade 4: severe
TRQ	38	Moderate

PATIENT DECISION

Cochlear implantation

Follow-up and outcomes

Visit	CNC Left[1]	AU	CIQoL-10	THI	TRQ	Patient experience / follow-up
Pre-op testing	0%	58%	27/50	59 Severe: G4	38	
Initial stimulation	N/A	N/A	N/A	N/A	N/A	Routine mapping, no concerns. Sound seemed strange and metallic on day one.
1 month	76%	92%	37/50	19 Mild: G2	17 Mild	Hearing well, but not yet localizing. Reports almost 100% audiobook understanding streamed to the CI ear alone.
3 months	84%	N/A	45/50	16 Slight: G1	14 Slight	Now able to localize sound. Continues to do well and is very satisfied.
6 months	90%	N/A	47/50	10 Slight: G1	9 Slight	Very pleased. She forgot her CI one day and it exposed listening and localization difficulties. Right-ear hearing test / HAE scheduled.

[1] Contralateral ear masked.

CASE TAKEAWAY

For Lucy, CI benefit included improved speech recognition, better managed tinnitus, and reported improved localization by 3 months. She needed to focus on one ear at a time.

Charlie: Patient History

68 y/o M / Retired Pastor

TIMELINE

March 2020	Sudden left sensorineural hearing loss of unknown cause. Approximately three years of hearing loss at evaluation.
Treatment	Multiple courses of oral and intratympanic steroids produced no meaningful hearing recovery.
Daily impact	Active lifestyle and daily exercise, but significant listening fatigue and difficulty following group conversations.
Tinnitus	Left-sided tinnitus, especially when focusing on it. Uses a noise machine at night.

PATIENT GOALS

01 Hear from the left

Improve access to people speaking on his poorer-hearing side.

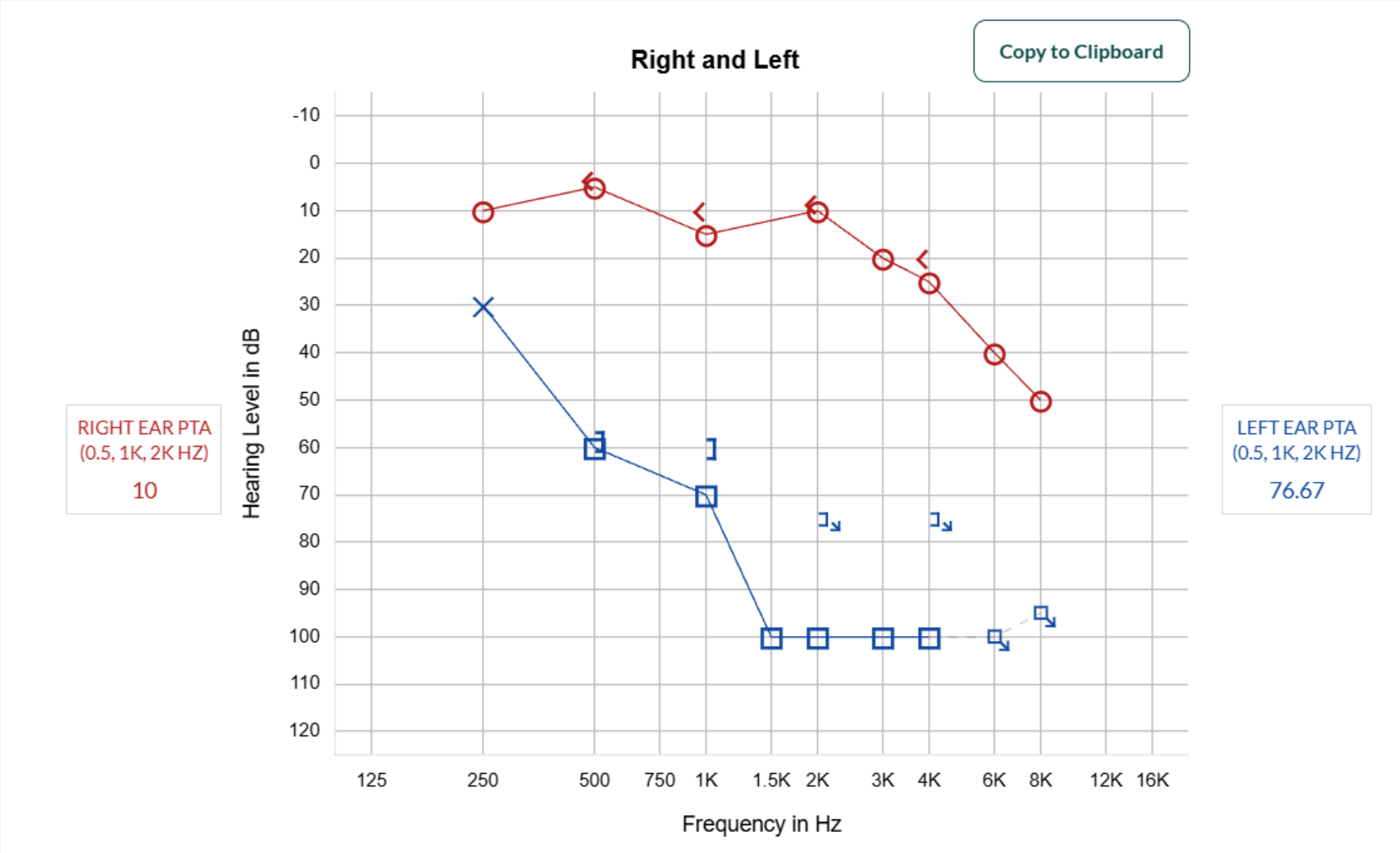
02 Join group dinners

Follow conversation with his wife and friends instead of avoiding dinners.

03 Avoid surgery

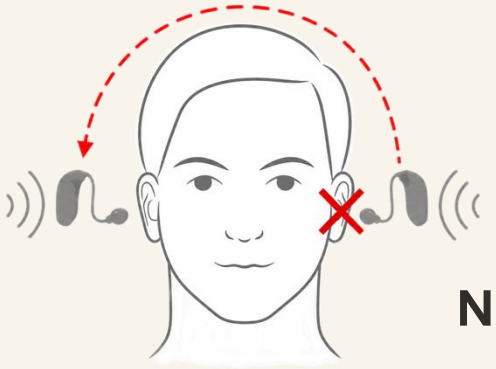
Find a nonsurgical option that fits his communication needs.

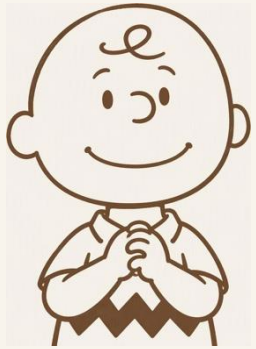
Audiogram



Word Discrimination Score	
Right	100%
Left	0%

Evaluation





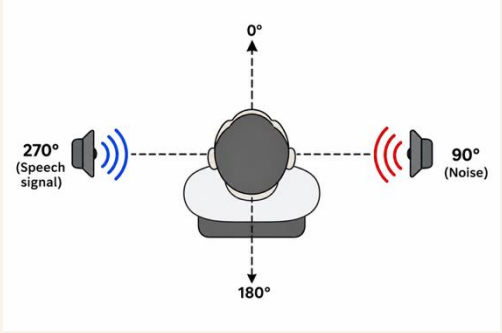
SUMMARY

Speech 270°: left, poorer ear

Noise 90°: right, better ear

Device condition	SNR loss
Unaided	+11.5 dB
Right hearing aid only	+10.5 dB
BAHS softband + right hearing aid	+7.5 dB
BiCROS	+4.5 dB

SNR loss in dB: lower is better.



Option	Patient preference / experience
Surgery	Preferred to avoid cochlear implantation and implanted bone conduction.
ADHEAR	Disliked device size and had adhesive-related skin irritation.
BiCROS	Selected Phonak BiCROS after the nonsurgical trial.

PATIENT DECISION

Phonak BiCROS

Follow-up and outcomes

Stage	Patient experience	Management / preference
After BiCROS trial	Better access to people seated on his left at group dinners.	Selected Phonak BiCROS and reported high satisfaction.
Approximately 3 years of use	Continued using the system and remained very satisfied.	Relies on the devices and wants to avoid being without them.
Next planned step	Wants a backup in case his current devices lose effectiveness or fail.	Plans to use his insurance benefit to obtain a second BiCROS system.

CASE TAKEAWAY

BiCROS addressed Charlie's conversation goals and preferences. Sustained use and a planned backup reflect its value in daily life.

Sally: Patient History

55 y/o F / Pediatrician

TIMELINE

Approx. 2002	Left Ménière's disease began to progress to profound loss with no responses at audiometer limits. Vertigo decreased.
Better ear	Right hearing declined to mild-to-moderate SNHL, increasing communication difficulty and listening fatigue. Patient noted ***she was grieving her loss***.
Medical care	Fluctuating right hearing required oral and intratympanic steroids. Referred for CI eval by ENT: November 2023.
BiCROS trial – 11/23/25	No prior hearing aid use. A BiCROS trial before decision was made helped to build confidence.

PATIENT GOALS

01 Everyday listening

Hear her son, enjoy music, and communicate in daily settings.

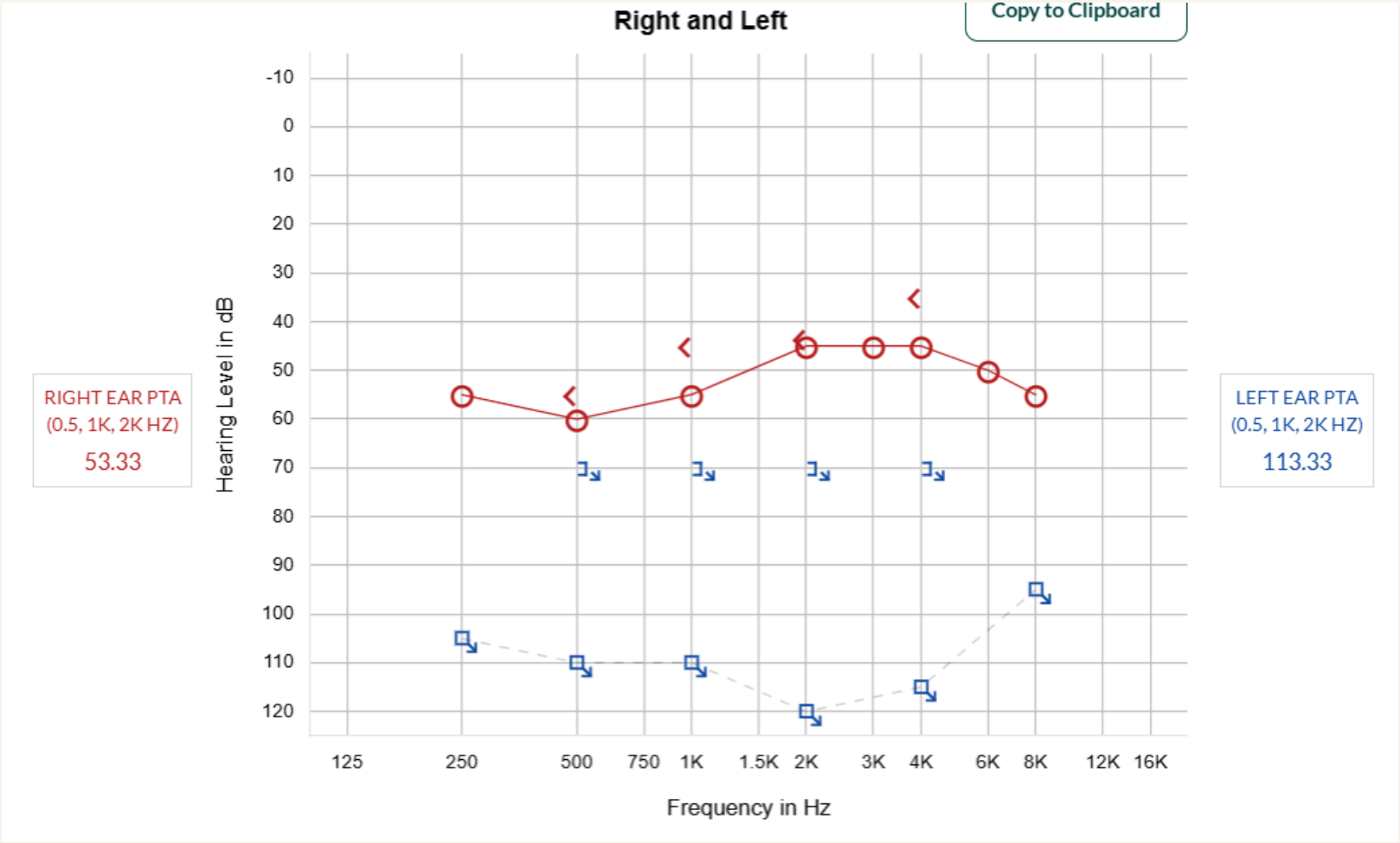
02 Pediatric practice

Hear patients clearly and continue using her stethoscope.

03 Informed choice

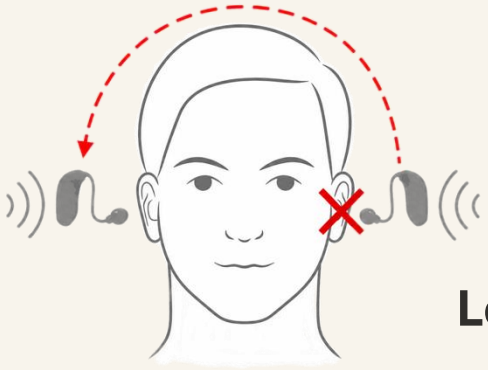
Avoid surgery while CROS helps. Understand delay and keep CI as an option.

Audiogram



Word Discrimination Score	
Right	84%
Left	CNT

Evaluation



SUMMARY

Right ear Mild-to-moderate SNHL
Fluctuating thresholds

Left ear Profound SNHL

Test / condition	Score
Right CNC, aided	88%
Left CNC, aided	0%
Bilateral AzBio, quiet, 55 dB	100%
Bilateral AzBio, +10 dB SNR	57%

Option	Patient preference / experience
BAHS	Preferred to avoid surgery for BAHS, especially if goal was similar to CROS and she would still wear a hearing aid in the right ear
Cochlear Implant	Duration of deafness >10 years, patient counseled on limited/low speech recognition benefit
BiCROS	Patient very satisfied with BiCROS trial

PATIENT DECISION

ReSound BiCROS

Follow-up and outcomes

Stage	Patient experience	Management / preference
January 2026	Better able to hear patients and family with the fitting of her BiCROS system.	Reported high satisfaction: music, conversation, and hearing patient heartbeats
May 2026	Continued using the system and remained very satisfied, elected to explore CI	Did not want to leave out possibility of CI benefit; understood counseling of limited word recognition benefit after extended deafness. “I don’t want perfection to be the enemy of very good.”
Currently	Proceeding with CI surgery (in process).	TBD.

CASE TAKEAWAY

Meaningful BiCROS benefit supported Sally’s decision to defer CI. Allowed her to make an informed decision to pursue CI at a later date.

Beyond Audiologic Candidacy

Clinical eligibility begins the conversation.

Audiologic candidacy

Patient-specific listening challenges

Individual goals and priorities

Expected benefits and limitations

Preferences and readiness

Making Evidence-Based Care Practical

01 Listen
Identify primary listening challenges

02 Define
Establish individualized goals

03 Assess
Use targeted testing and patient reports

04 Explain
Discuss benefits, limitations and trade-offs

05 Collaborate
Support shared decision-making

06 Reassess
Review outcomes and goals over time

Three Things to Remember

01 The audiogram is the starting point. Understand the patient's real-world challenges rather than jumping to candidacy.

02 Every intervention involves trade-offs. Explain both capabilities and limitations.

03 The decision is individualized. Combine evidence with goals and informed preferences.

From Evidence to Individualized Care

Our goal is to help patients understand what is possible, what is realistic, and what matters most to them.

Questions & Discussion

Questions?

REFERENCES

- Dillon, S., et al. (2022). American Cochlear Implant Alliance Task Force guidelines for adult cochlear implantation in single-sided deafness. *Ear and Hearing.*
- Dillon, H., James, A., & Ginis, J. (1997). Client Oriented Scale of Improvement (COSI). *Journal of the American Academy of Audiology, 8*(1), 27–43.
- Gatehouse, S., & Noble, W. (2004). The Speech, Spatial and Qualities of Hearing Scale (SSQ). *International Journal of Audiology, 43*(2), 85–99.
- Peters, J. P. M., et al. (2021). Short-term outcomes of cochlear implantation for SSD: CINGLE randomized controlled trial. *PLOS ONE.*
- van Heteren, J. A. A., et al. (2024). Sound localization in single-sided deafness: Outcomes of a randomized controlled trial. *Trends in Hearing, 28.*
- Wendrich, A. W., et al. (2024). CINGLE randomized controlled trial: 24-month tinnitus outcomes. *Frontiers in Neurology.*
- Asfour, L., et al. (2025). The role of patient motivation in single-sided deafness: Treatment selection and cochlear implant outcomes. *Journal of Clinical Medicine, 14*(24), 8944.
- Hoppe, U., et al. (2022). Speech perception in bilateral hearing aid users with different grades of asymmetric hearing loss.
- Potier, M., et al. (2025). Effects of StereoBiCROS on speech understanding in noise and quality of life for asymmetric sensorineural hearing loss. *Audiology Research, 15*(6), 176.