

Restoring Sound: Care for Severe Hearing Losses

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Key Takeaways

Key Takeaway	Clinical Implication
Hearing threshold at 2000 Hz is pivotal for receiver selection	Use the 2000 Hz threshold, along with Speech MCL and UCL measures, to select the appropriate receiver gain tier (L/40 through UP/70).
Earmold material affects gain, occlusion, and comfort	Choose hard material for mild-to-moderately-severe loss and soft material for moderate-to-profound loss, based on pure tone average.
CROS and BiCROS systems address unilateral hearing loss	Confirm poor-ear and better-ear status before selecting CROS, BiCROS, or Hearing Aid Only mode for a given listening situation.
Frequency Lowering has defined candidacy criteria	Apply the Smart Candidacy Criteria audiometric thresholds before enabling Frequency Lowering, and set Bandwidth and Gain to match loss severity.
Speech understanding, not audibility alone, signals CI candidacy	Refer for cochlear implant evaluation per the 60/60 Guideline (adults) or CI 3-60 Guideline (pediatric) when word recognition or PTA thresholds are met.
Cochlear implant referral is underutilized	Recognize that only 5–12% of eligible adults receive a cochlear implant, and use referral tools like the 60/60 guideline to identify candidates earlier.

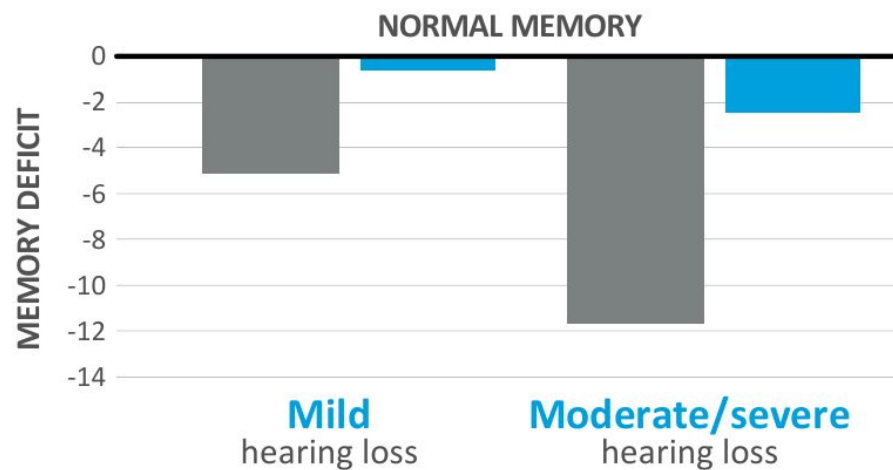
Learner Outcomes

- Describe audiometric criteria that suggests Frequency Lowering benefit.
- Describe 3 programmable CROS modes/configurations.
- Identify at least 2 criteria for recommending a cochlear implant evaluation.

Testing Considerations

The Value of Hearing Aids

Hearing loss may decrease older adults' participation in social activities and increase the likelihood of developing depression and anxiety. This in turn may affect cognition, reduce physical activity and competence, and increase risk of falls (Agmon et al., 2017).



● Non-hearing aid users ● Hearing aid users

Source: *JAMA Otolaryngol Head Neck Surg.* 2018 Oct; 144(10): 876–882.

Figure 1. Memory deficit scores by hearing loss severity, comparing hearing aid users and non-users.

Hearing Evaluation — Audiogram

- Pure tone testing
- Air conduction and bone conduction
- Speech testing
- UCL/LDLs and MCLs

Speech-in-Noise Testing

Speech-in-noise testing measures the most common complaint of patients with hearing loss. It is easy, fast, and reliable, and can help predict hearing aid use, guide technology choices, assess hearing aid benefit, and support compliance with best-practice guidelines.

Performance in noise can't be reliably predicted from the pure tone audiogram or other standard audiometric tests.

Speech-in-noise hearing impairment is associated with a 61% increased risk of dementia (Journal of the Alzheimer's Association, 2021).

Hearing Aid Selection

Receiver Selection

Use hearing threshold at 2 kHz to determine gain requirements: 40 Gain/L, 50 Gain/M, 60 Gain/P, 70 Gain/UP.

Choosing the Right Matrix

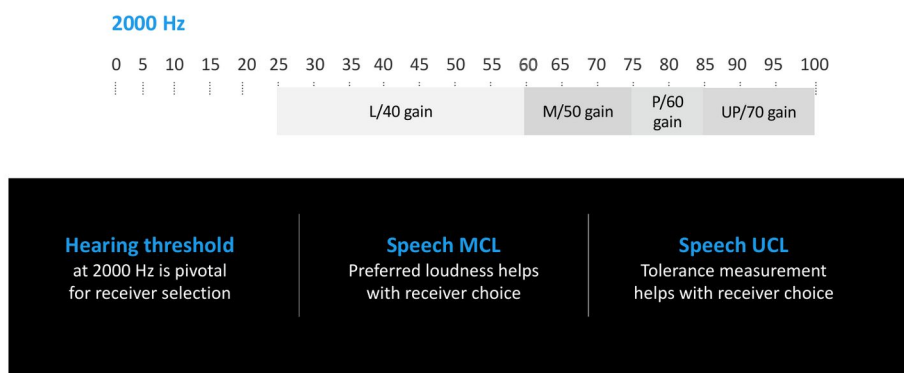


Figure 2. Receiver gain tier selection scale based on hearing threshold at 2000 Hz.

Q1

Quiz Hint: Receiver selection is guided by the hearing threshold measured at 2000 Hz, which is described as pivotal for determining gain requirements. Speech MCL (preferred loudness) and Speech UCL (tolerance) further refine the choice.

Poor high-frequency thresholds should not determine hearing aid gain — high-frequency gain that overpowers low frequencies can introduce distortion and impact sound quality. In these cases, Frequency Lowering should be considered instead.

RIC and BTE Styles

Receiver-In-Canal (RIC) styles include hollow canal, occluded helix, canal helix, skeleton, canal lock, and custom-cased canal or canal-lock options.

Behind-The-Ear (BTE) styles are available with thin tube or standard tubing, in CIC, canal, canal lock, half shell, shell, skeleton, and open configurations.

Canal Length and Earmold Style

Selection depends on hearing loss and gain and output requirements. The canal portion contributes the most to occlusion effect and the maximum gain requirements of the BTE.

Earmold Material

Hard material is suitable for mild to moderately-severe hearing loss. Soft material is suitable for moderate to profound hearing loss. If the audiogram is sloping, use the pure-tone average (PTA) of 500, 1000, and 2000 Hz to guide the decision — a higher degree of dexterity is required to manipulate a very flexible earmold.

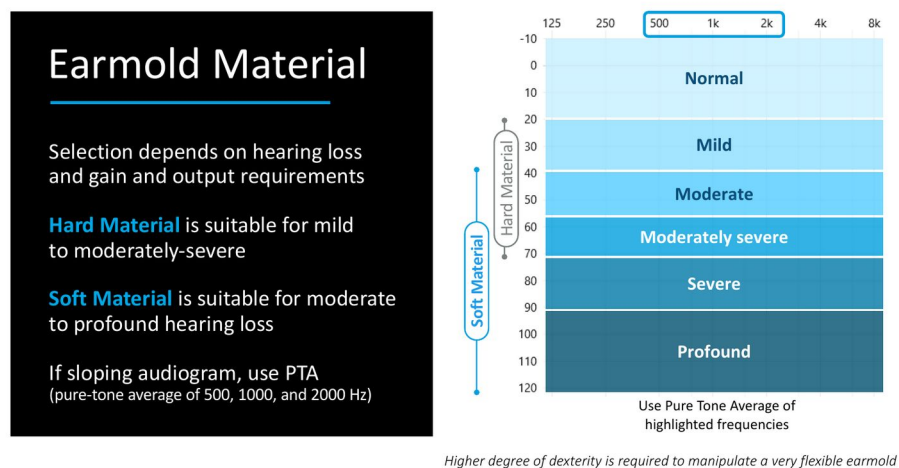


Figure 3. Earmold material selection by hearing loss severity.

Vent Selection

Use 500–750 Hz thresholds to determine vent requirements (No Vent, 1 Vent, 2 Vent, or 3 Vent / BAV).

Fitting Considerations

Dynamic Range

Normal hearing has a dynamic range (DR) of approximately 110 dB between the threshold of audibility and the loudness discomfort level (LDL). In hearing-impaired ears, that dynamic range narrows — in the example shown in the source material, to about 60 dB — which is why fitting aims to mimic the dynamic nature of the intact auditory system: fitting the full world of sound into a narrower dynamic range.

Fitting Formulas

Formula	Description
NAL-R	Linear formula utilizing a loudness equalization rationale.
NAL-NL1	Developed from NAL-R; uses Wide Dynamic Range Compression (WDRC) based on a predictive model for speech intelligibility (derived ANSI SII) and a loudness normalization rationale.
NAL-NL2	Developed from empirical data collected over a decade on NAL-NL1; retains WDRC, loudness normalization, and a predictive model of speech intelligibility as its primary goals.
e-STAT 2.0	Starkey's proprietary fitting formula. Emphasizes audibility for speech understanding, developed for Starkey's proprietary compression architecture, and optimizes response modeling and vent/hearing-aid interaction regardless of hearing aid style.

When to Consider CROS

CROS Candidacy

Candidacy requires total unilateral hearing loss (single-sided deafness, congenital or acquired) plus one of the following: no amplification benefit, very poor word recognition score (WRS) with hyperacusis, or very poor WRS with binaural presentation.

CROS and BiCROS

CROS (Contralateral Routing of Signal) is for a patient with one ear that is unaidable or has very poor WRS, and one normal or better-hearing ear. A microphone on the poor ear routes signal to an amplifier and transducer on the better ear.

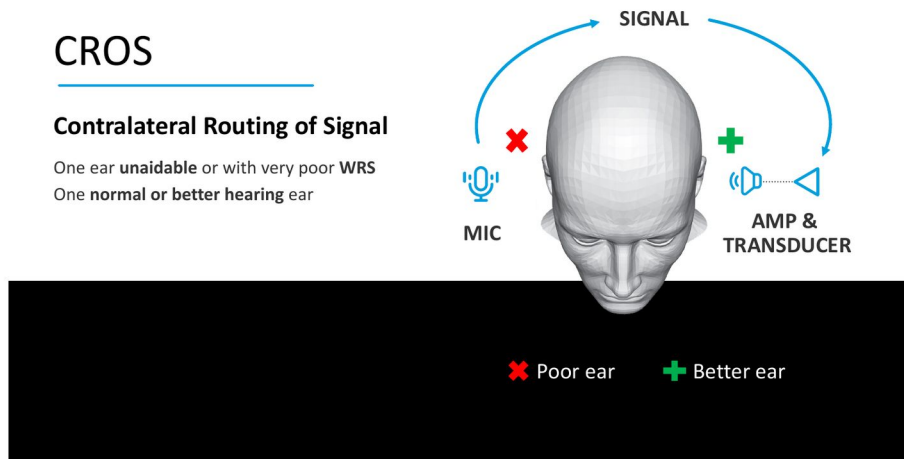


Figure 4. CROS signal routing from the poor ear to the better ear.

BiCROS (Binaural Contralateral Routing of Signal) is for a patient with one ear that is unaidable or has very poor WRS, and one impaired ear that also requires amplification — the better ear receives both its own microphone signal and the routed signal.

The Wireless CROS System

The system consists of a Transmitter (worn on the unaidable ear, microphone enabled for CROS and/or BiCROS) and a Receiver (worn on the normal or better ear, microphone enabled for BiCROS or Hearing Aid Only mode). "CROS stream" refers to audio streamed from the Transmitter to the Receiver.

CROS System Modes

- CROS Mode — Transmitter on, Receiver microphone off. Signals picked up on the poor side are sent to the good side (e.g., in a meeting with voices on the right side).
- BiCROS Mode — Transmitter and Receiver microphones both on. Signals are picked up from both sides (e.g., a meeting around a table with voices on both sides). A CROS patient can benefit from switching to BiCROS mode by accessing independent directionality and noise control.
- Hearing Aid Only Mode — Transmitter microphone off. Signals on the poor side are not sent to the good side (e.g., in the car with the poor ear by the window, or in noisy situations).

Q2

Quiz Hint: A wireless CROS system's selectable program options are CROS Mode, BiCROS Mode, and Hearing Aid Only Mode.

Balance Control

Balance control adjusts the level of sounds coming from the Transmitter relative to the Receiver in BiCROS mode.

When to Consider Frequency Lowering

Rationale

Precipitous high-frequency hearing loss is associated with feedback potential, reduced bandwidth, and cochlear distortion — considerations that support the use of Frequency Lowering.

Smart Candidacy Criteria

Smart Candidacy Criteria automatically identify ideal candidates for Frequency Lowering when: all thresholds below 1000 Hz are 55 dB or better; the slope is greater than 25 dB per octave between 250 Hz and 4000 Hz; any threshold between 1000 Hz and 3000 Hz is 55 dB or worse; and all thresholds between 4000 Hz and 8000 Hz are 55 dB or worse.

Q5

Quiz Hint: Smart Candidacy Criteria were developed to automatically identify ideal candidates for Frequency Lowering, based on defined thresholds and slope across specific frequency ranges.

Frequency Lowering Bandwidth and Gain

Frequency Lowering Bandwidth adjusts the Source and Target regions where high-frequency information is copied and replicated, with 7 discrete settings available.

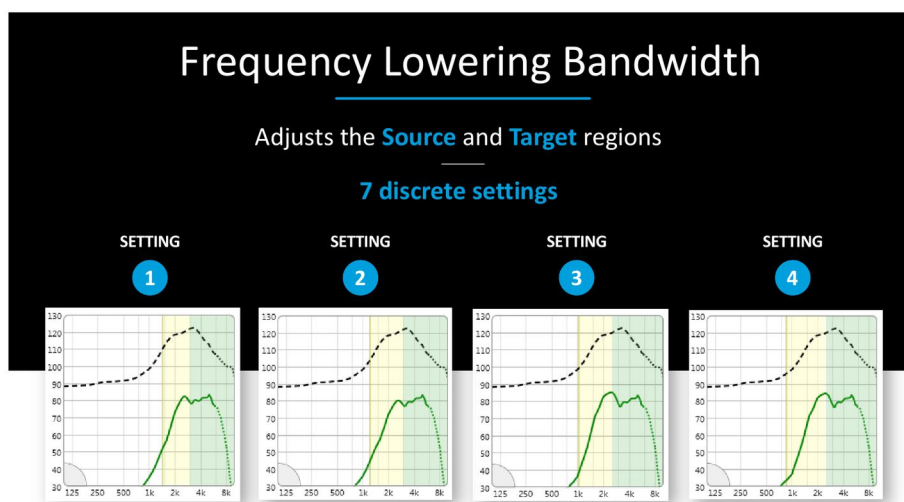


Figure 5. Frequency Lowering Bandwidth settings 1 through 4, showing source and target region shifts.

Q3

Quiz Hint: The Frequency Lowering Bandwidth control adjusts the source and target regions where high-frequency information is copied and replicated, offering 7 discrete settings.

Frequency Lowering Gain controls the amount of replicated signal, extending from 0 dB to 10 dB and adjustable in 1 dB increments.

Best Fit and Manual Engagement Settings

Best Fit Settings: a Bandwidth of 5 is recommended for severe-to-profound hearing loss and 3 for moderate-to-moderately-severe hearing loss; a Gain of 3 is recommended for all hearing losses.

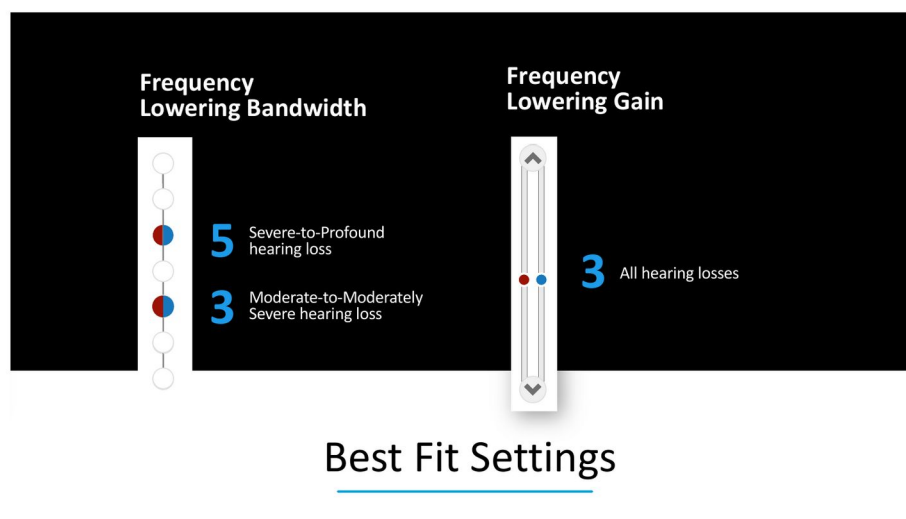


Figure 6. Best-fit Frequency Lowering Bandwidth and Gain settings by hearing loss severity.

Manual engagement uses default logic as a guide, with professional judgement applied when PTA is asymmetrical by a slight amount, or by default for patients under 18. Manual settings: Bandwidth 5 when 4k–8k thresholds are ≥ 70 dB, Bandwidth 3 when 4k–8k thresholds are 55–65 dB, Bandwidth 1 with Gain 0 otherwise; Gain of 3 for moderate hearing loss.

When to Consider a CI Evaluation

Who Should You Consider?

Consider a cochlear implant evaluation for patients who are hearing but not understanding, have had repeated hearing aid adjustments with limited improvement, show poor speech understanding, report increased listening effort, experience social withdrawal, face academic or workplace challenges, or whose family or caregivers express concerns.

Beyond the Audiogram

Candidacy considerations extend across three domains:

Beyond The Audiogram

Clinical Factors	Patient Factors	Practical Factors
• Unaided thresholds • Aided speech understanding • Hearing aid benefit • Duration of hearing loss	• Communication needs • Personal goals • Motivation and expectations	• Medical/surgical considerations • Insurance and payer requirements

Figure 7. Clinical, patient, and practical factors relevant to cochlear implant candidacy.

Beyond hearing itself, these factors affect communication with family and friends, listening effort and fatigue, work and school performance, social participation, safety and independence, and overall quality of life.

Beyond Access

Only 5–12% of eligible adults receive a cochlear implant. The greatest barrier isn't technology — it's delayed recognition and referral. Simple referral tools, like the 60/60 guideline, can help identify patients earlier. Despite established evidence of benefit in children, only 50% of eligible children in the US receive a cochlear implant, compared with pediatric cochlear implant access rates of 90% or more in several European countries, Australia, and New Zealand, according to the WHO.

The Revised 60/60 Guideline

A cochlear implant evaluation is indicated when the word recognition score is 60% or less in the better ear, or the pure tone average is 60 dB HL or higher at 500, 1000, and 2000 Hz in the better ear.

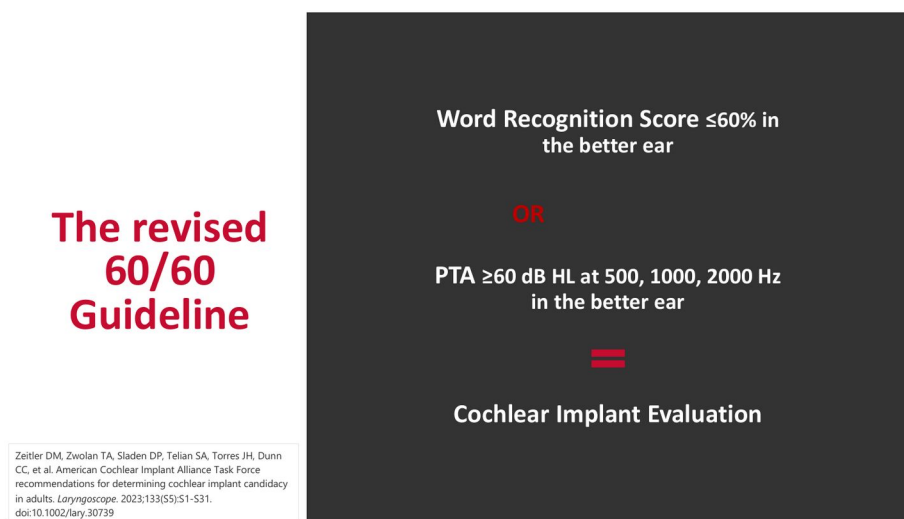


Figure 8. The revised 60/60 Guideline for adult cochlear implant referral.

Q4

Quiz Hint: The revised 60/60 Guideline points to a cochlear implant evaluation when the word recognition score is 60% or lower, or the pure tone average is 60 dB HL or higher, in the better ear.

Pediatric CI 3-60 Guideline

A cochlear implant evaluation is indicated when the unaided four-frequency PTA is ≥ 60 dB HL, or the aided Speech Intelligibility Index is ≤ 0.60 , or word recognition is $\leq 60\%$.

Pediatric CI 3-60 Guideline

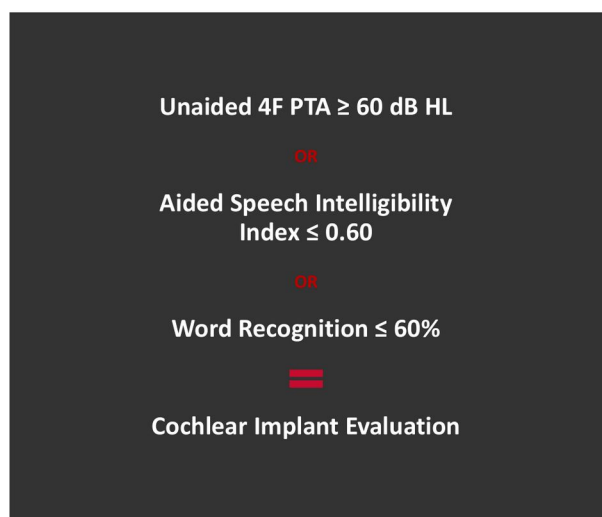


Figure 9. The Pediatric CI 3-60 Guideline for cochlear implant referral.

MED-EL Cochlear Implant Candidacy

MED-EL has the widest CI criteria in the industry. FDA-approved criteria for ages 18 and older include moderate-to-profound sensorineural hearing loss (low-frequency PTA at 250/500/1000 Hz greater than 40 dB HL, no better than 65 dB HL at 3000 Hz or higher) and limited benefit from hearing aids (50% correct or less on CNC words in the ear to be implanted; 60% correct or less in the non-implant ear).

MED-EL's pediatric indication extends to children as young as 7 months, with improved candidacy from 12 months and older. The SSD/AHL indication covers ages 5 and older with profound SNHL in one ear and normal-to-moderately-severe SNHL in the other ear, where amplification benefit is less than 5% on single-syllable word lists in the profound ear.

MED-EL FLEX electrode arrays are FDA-approved to help preserve existing residual low-frequency hearing, including the FLEX24, FLEX26, FLEX28, and FLEXSOFT long-electrode options.

Medicare coverage considerations for cochlear implant candidacy include audiologic, medical, and functional criteria.

Conclusion — Think Beyond Hearing Aids When

- Hearing aids have been appropriately fit, but communication remains difficult
- Speech understanding is poor (60/60 or Pediatric CI 3-60 Guidelines)

- Patients continue struggling
- Family members express ongoing communication concerns
 - Ask: "Could this patient benefit from a cochlear implant evaluation?"

Interactive Worksheet

Complete each fillable field below as you work through the course content. Click into any bordered box to type your response.

Learning Objectives

- Describe audiometric criteria that suggests Frequency Lowering benefit.
- Describe 3 programmable CROS modes/configurations.
- Identify at least 2 criteria for recommending a cochlear implant evaluation.

Module 1 — Hearing Aid Selection & Fitting

Key Terms

Term	Definition
Receiver (RIC)	Click here to enter text.
Dynamic Range (DR)	Click here to enter text.
Pure Tone Average (PTA)	Click here to enter text.

The hearing threshold at _____ Hz is described as pivotal for receiver selection:

Click here to enter text.

Hard earmold material is suitable for which severities of hearing loss, and soft material for which severities?

Click here to enter text.

Pause & Apply (If-Then): If a patient has a sloping audiogram, then I will use _____ to guide earmold material selection.

Click here to enter text.

Module 2 — CROS and BiCROS Systems

Key Terms

Term	Definition
CROS	Click here to enter text.
BiCROS	Click here to enter text.
Transmitter / Receiver	Click here to enter text.

List the criteria that qualify a patient for CROS candidacy:

Click here to enter text.

Describe the difference between CROS Mode and BiCROS Mode:

Click here to enter text.

Pause & Apply (If-Then): If my patient's poor ear faces away from most conversation partners in a group setting, then I will consider _____ mode.

Click here to enter text.

Module 3 — Frequency Lowering

Key Terms

Term	Definition
Frequency Lowering Bandwidth	Click here to enter text.
Frequency Lowering Gain	Click here to enter text.
Smart Candidacy Criteria	Click here to enter text.

List the Smart Candidacy Criteria thresholds for engaging Frequency Lowering:

Click here to enter text.

The Frequency Lowering Bandwidth control adjusts the _____ and _____ regions.

Click here to enter text.

Pause & Apply (If-Then): If a patient's audiogram shows all thresholds below 1000 Hz at 55 dB or better with a slope greater than 25 dB per octave, then I will _____.

Click here to enter text.

Module 4 — Cochlear Implant Evaluation Criteria

Key Terms

Term	Definition
60/60 Guideline	Click here to enter text.
Word Recognition Score (WRS)	Click here to enter text.
Pediatric CI 3-60 Guideline	Click here to enter text.

According to the revised 60/60 Guideline, a patient should be referred for a CI evaluation when their WRS is _____ or their PTA is _____.

Click here to enter text.

List two signs that a patient may benefit from a CI evaluation beyond amplification:

Click here to enter text.

Pause & Apply (If-Then): If a patient reports ongoing frustration understanding speech despite well-fit hearing aids, then I will _____.

Click here to enter text.

Clinical Case — Unfolding Scenario

Part 1 (Introduction): A 68-year-old patient presents with unilateral profound hearing loss in the left ear (single-sided deafness) and normal hearing in the right ear. What clinical data is most relevant to gather first?

Click here to enter text.

Part 2 (Assessment Data): Audiometric testing confirms no measurable amplification benefit in the left ear and normal thresholds in the right ear. What device option would this data support, and why?

Click here to enter text.

Part 3 (Complicating Factor): Several months later, the patient reports continued difficulty understanding speech in group settings, even with the CROS system in place. Word recognition testing in the right ear now measures 55%, with a PTA of 65 dB HL. How does this change your recommendation?

Click here to enter text.

Part 4 (Application): Identify any red flags or referral criteria that apply to this patient's updated presentation.

Click here to enter text.

Clinical Reference Tool

CROS/BiCROS Candidacy & Mode Selection Checklist

Step	Consideration	Notes
1. Confirm poor-ear status	Unaidable or very poor WRS with hyperacusis, or very poor WRS with binaural presentation	Click here to enter text.
2. Confirm better-ear status	Normal or better hearing in the contralateral ear	Click here to enter text.
3. Select CROS vs. BiCROS	CROS: better ear needs no amplification. BiCROS: better ear is also impaired and requires amplification.	Click here to enter text.
4. Choose transmitter/receiver style	Style must be consistent with receiver (RIC RT or RIC 312)	Click here to enter text.
5. Set initial mode	CROS / BiCROS / Hearing Aid Only mode based on the listening environment	Click here to enter text.

This tool is for clinical reference only. Always follow your facility's protocols.

Post-Course Reflection

What was the most significant thing you learned today that surprised you or challenged your existing practice?

[Click here to enter text.](#)

What knowledge gaps did this course reveal in your own skills or knowledge?

Click here to enter text.

Describe a specific patient or client from your own practice where you would apply the CROS, Frequency Lowering, or CI referral criteria discussed today:

Click here to enter text.

What is one thing you will do differently in your practice next week as a result of this course?

Click here to enter text.

Action Plan

Identify at least 2 specific, measurable changes you plan to make to your clinical practice as a direct result of this course. Use the If-Then format where possible: "If I encounter [situation X], then I will [action Y]."

My Action Plan Goal	Target Date	How I Will Measure Success
Click here to enter text.	Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.	Click here to enter text.

Quiz Summary

The following quiz hints appeared throughout the course content. Use this section as a quick study reference.

Q1

Quiz Hint: Receiver selection is guided by the hearing threshold measured at 2000 Hz, which is described as pivotal for determining gain requirements. Speech MCL (preferred loudness) and Speech UCL (tolerance) further refine the choice.

Q2

Quiz Hint: A wireless CROS system's selectable program options are CROS Mode, BiCROS Mode, and Hearing Aid Only Mode.

Q3

Quiz Hint: The Frequency Lowering Bandwidth control adjusts the source and target regions where high-frequency information is copied and replicated, offering 7 discrete settings.

Q4

Quiz Hint: The revised 60/60 Guideline points to a cochlear implant evaluation when the word recognition score is 60% or lower, or the pure tone average is 60 dB HL or higher, in the better ear.

Q5

Quiz Hint: Smart Candidacy Criteria were developed to automatically identify ideal candidates for Frequency Lowering, based on defined thresholds and slope across specific frequency ranges.

References

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Additional Information

Presenter Bio

Lawanda Chester received her Au.D. degree from the University of Florida and has practiced Audiology in a variety of clinical settings for over 10 years. She began working within the hearing devices industry with a focus on education and training in 2009 and earned her Trainer certification in 2012. Dr. Chester joined Starkey Hearing Technologies in early 2016.

Dr. Annie Rodriguez is an audiologist and Market Development Manager at MED-EL Corporation. She earned her Doctor of Audiology degree from Nova Southeastern University and has a clinical background with a strong focus on cochlear implants. Prior to joining industry, Dr. Rodriguez worked at the University of Miami, where she supported patients and families throughout their hearing journey as part of a multidisciplinary clinical team.

In her current role at MED-EL, Dr. Rodriguez leads market development and expansion initiatives focused on expansion to implant care, strategic partnerships, bimodal hearing, and clinical education. Her work bridges clinical practice and commercial strategy. She develops clinician-facing resources and trainings, supports sales and market expansion efforts, and collaborates cross-functionally to help audiologists integrate new solutions into everyday practice. As a bilingual audiologist, she also brings cultural and linguistic insight to initiatives supporting Spanish-speaking patients and providers.

Presenter Disclosure

Financial: Lawanda Chester is employed by Starkey.

Non-financial: Lawanda Chester has no relevant non-financial relationships to disclose.

Financial: Annie Rodriguez is an employee of MED-EL and has no other relevant financial disclosures.

Non-financial: Annie Rodriguez does not have any relevant non-financial disclosures.

Additional Information (continued)

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- It is the responsibility of course participants to critically evaluate the evidence from multiple sources to guide professional practice.

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