

Aural Rehabilitation for Children & Adults with Cochlear Implants

"A person hears only what they understand."

Johann Wolfgang von Goethe

Candidacy Criteria Has Changed

- **Adults**
 - Moderate to profound SNHL in both ears, sentence recognition $\leq 50\%$ and $\leq 60\%$ in opposite ear.
- **Children 2-17 years**
 - Severe to profound SNHL bilaterally, limited benefit from amplification, MLNT or LNT scores $\leq 30\%$.
- **Children 9-24 months**
 - Profound SNHL bilaterally, limited benefit from amplification.

ACI Alliance Task Force Guidelines for Determining Cochlear Implant (CI) Candidacy in Children with Hearing Loss

- Child not making progress in speech and language
- Earlier CI leads to better outcomes
- Having residual hearing should not be a deterrent
- No inappropriate referrals for evaluation as counseling is always helpful
- Family commitment to appropriate therapy
- Evidence-based practice to guide clinical decision-making—not payor policies, FDA or Medicaid guidelines

www.acialliance.org/page/DeterminingCICandidacy

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ACI Alliance Task Force Guidelines for Clinical Assessment of Cochlear Implants (CI) in Children with Single-Sided Deafness (SSD)

- At risk for hearing loss progression in better ear
- Dx bacterial meningitis
- Advantage of younger CI
- Developmental disadvantages of SSD due to difficulties with localization, hearing in noise, listening fatigue
- Auditory therapy strongly recommended

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Asymmetrical or Single Sided Deafness

Centers often rely heavily on low-context stimulus, e.g. CNC word lists, to isolate the capabilities of the ear in question. This helps to bypass the patient's ability to use higher-level processing to decode incomplete information that may cloud clinical decision making.

Cleveland Clinic: "We consider the capability of each ear independent of the contralateral side and recommend CI anytime we expect improved outcomes..."

Our focus today Auditory Instruction

- Improve listening skills and help develop strategies for capitalizing on the device being used.
- Most individuals with a significant hearing loss who receive a CI will require systematic, step-by-step habilitation, following a model, enhanced by effective carryover in meaningful daily activities.
- A single well-defined hierarchy of listening skills (and speech-language development when appropriate) will not fit every person.

Prelingual/Congenital
Babies through age 5

Progressive or Sudden
Onset
Any age past 5

CI for Single Sided
Deafness or
Asymmetrical Loss
Any age

Prelingual/Congenital, age birth to 5

- The good news? We're starting early - and early is better.
 - Plasticity
 - No issues with cross-modal reorganization
 - Developmental synchrony
- The bad news? This child most likely doesn't have language, so we have to teach language and audition hand-in-hand.

Hierarchy of Auditory Development in Babies Our Roadmap

- Auditory Awareness & Perception
- Auditory Attention & Inhibition
- Distance Hearing
- Localization
- Auditory Discrimination
- Auditory Feedback & Monitoring
- Auditory Memory & Sequencing
- Auditory Processing

Two Potential Situations

Individual has no prior listening experience

Individual has prior listening experience

Progressive Loss or Sudden Loss

- These individuals already have language.
- Their brains know what to do with sound.
- Our job is to help their brain make the connection with the new signal.
- Therapy is likely to be short-term, and will need to be customized to meet the challenges that individual is facing.

Where to Start?

Go back to the roadmap

- Auditory Awareness & Perception
- Auditory Attention & Inhibition
- Distance Hearing
- Localization (possibly)
- Auditory Discrimination
- Auditory Feedback & Monitoring (possibly)
- Auditory Memory & Sequencing
- Auditory Processing

What have they been advised to do?

- Wear their new device/s full time
- Spend time each day with only the CI, removing the HA on the other ear
- Listen to books on tape, read out loud, etc

Two Primary Ways to Address Rehab

Bottom up vs Top down - We Need Both

- **Bottom Up**
 - Understand the difference between sounds and words
 - Understand new sounds that have not been heard before
 - Ex: *boat vs bone*
- **Top Down**
 - Understand connected language, using linguistic knowledge to help understand the message as a whole.
 - Ex: *What did you eat for breakfast today?*

Bottom Up

Move from maximal differences toward smaller contrasts

- 3 syllable vs 1 syllable (ex: umbrella vs. shoe)
 - 1 syllable vs 2 syllable OR 2 syllable vs 3 syllable (ex: bug vs french fries OR monkey vs strawberry)
 - 1 syllable vs 2 syllable vs 3 syllable (ex: whale vs scissors vs kangaroo)
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- Start with small sets and gradually increase them, up to 10-12.
 - Once this is done, you can start on actual vowel and consonant discrimination.

Vowel & Consonant Discrimination

- Sets of two words of the same length, differing as maximally as possible

<i>blueberries v elephant</i>	<i>butterfly v grandfather</i>	<i>bicycle v telephone</i>
<i>baseball v scissors</i>	<i>toothbrush v lion</i>	<i>airplane v baby</i>
<i>moon v shout</i>	<i>chip v box</i>	<i>fish v eye</i>

- Once this is smooth in a range of contrasts, increase the number of words to 6-8 in a set.
 - When you do this, your contrasts are going to become less pronounced and words are going to get closer

Make differences less distinct...

- Words with the same vowels but different consonants
 - *train, rake, whale, snake, cake, game, rain, grapes*
 - *bug, gun, truck, sun, cup, one, duck*
- Words with the same consonants but different vowels
 - *cake, coke, kick, cook*
 - *whale, wool, wheel, while, well*
- Words that rhyme
 - *two, do, new, true, boo, who, Lou, moo, Pooh, Sue, you, shoe, chew*

Confusions - They WILL Happen

What to do...

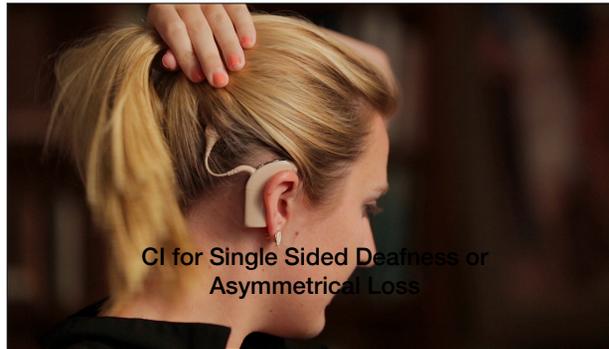
- Break out the items that are causing the confusion.
 - Example: We are working on rhyming words that end in "_ay" in a set of 6. The confusion tends to happen around "kay" and "tay". I will pull those two words out of the larger set and we'll contrast them. My job is to help the client hear the difference so we'll experiment with pointing out some differences, changing my production to help make it more clear, etc.
- Confusions are common among "p, b, t, d, k, g", "m, n", "r, l", "s, sh", and so on. I watch for them and make sure we do some direct teaching to help resolve that confusion.

Keep in Mind...

- Find out where the challenge is - find the zone of proximal development to avoid working on things that are too easy OR too hard.
- Teach, don't just test.
- The brain does magic when people sleep - if you are stuck, let the brain work on it over night.
- If you are STILL stuck, there might need to be some mapping changes.
- Homework is critical.

Primary Differences

- We've missed the early intervention window.
- These listeners likely have had more visual access than auditory - we want to create links to information that has previously been stored as visual.
- The single most important goal when working with school-aged children with a new implant is to foster feelings of success with the device.
 - Intervention has to be relevant and immediately gratifying
 - May need to address English as well as auditory development
 - This group likely will need to target speech skills as well.



Challenges

- We have to isolate that ear.
- Plugging the normal ear won't completely block sound.
- Masking noise in the normal ear can cause central masking and make therapy way too hard
- We can isolate then ear through streaming and direct connect. Determine what accessories are available:
 - Cochlear - Mini Mic 2+ or a Roger system, auxiliary cable
 - AB - Roger, auxiliary cable
 - Med El - FM sleeve, 90/10 adapter cable

Set Up

- Zoom or other video-conference app.
- Parent and clinical connect by cell phone.
- Parent plugs headphones into their cell phone - must mute the mic on their phone.
- In the office - we can use pre-recorded stimuli.
- If the individual is at home with a parent or another adult, we can use live voice on our end and a listening hoop to block visual input.

Therapy Protocol at UNC Chapel Hill**

- For children 3-4 years or older
- 1st 9 weeks post-activation - move through programs
- At 9 week mapping, teach parents how to direct connect.
- Encourage families to do some direct connect practice at home before the first therapy session.
- Initial sessions focus on tele therapy set-up and input of familiar auditory stimuli.

Early Goals

- ID Ling six sounds
- ID familiar songs
- ID phrases and answering common question
- ID Learning to Listen Sounds
- ID 1, 2, 3, 4 syllable words

More Complex Goals

- ID object from related descriptions
- Imitate predictable sentences
- Answer questions about story with topic disclosed
- ID words within a category (animals, Halloween words, furniture)
- Minimal Pair Words with final consonants and vowels the same but initial consonant differing in manner (hat/cat) or voicing (bear/pear).

Last...

- ID absurdities (The sun shines at night)
- Retell details of a five sentence story
- Minimal Pair Words with final consonants and vowels the same, but initial consonants differing by place (boat/goat).

Issues

- Kids report that they can't hear. That doesn't usually mean that they hear silence - they can't understand what they're hearing.
- Using a wireless transmitter outside the room results in an intermittent signal.
- Bluetooth can be glitchy.
- Good internet is crucial.
- **Wear time is critical.**
- Children fatigue quickly - 15-30 minutes tends to be all they can handle when beginning listening.

Benefits

- Expectations are different than for children with bilateral loss.
- Not measured the same as bilateral CI users - benefit is often seen in localization, reduced fatigue, and better ability to understand speech in noise, rather than speech perception per se.
- UNC has done a lot of work on this, with some information from a small Med El sponsored study they conducted.
 - 20 children ages 3.5 to 6.5, varied etiologies, duration of deafness varied and was unknown for 9 subjects.
 - All had normal cognition and typical spoken language skills.
 - Progress checked at 2 wks, 5 wks, 3 mos, 6 mos, 9 mos and 12 mos post activation

- Therapy for 12 months - every other week for first 6 mos, then once a month for the remaining 6 mos, in clinic or tele therapy with home carryover.
- Trend for improvement in all skills between 2 weeks and 9 months - progress tapered off around 9 months.
- Most children developed the ability to ID songs, stereotypic phrases, answer common questions from a closed set, and identify words from categories by 6 mos post-CI.
- Most were able to identify multi-syllabic words from an open set, and answer questions about a paragraph with the topic disclosed by 9 mos post-CI
- Performance with speech babble, identifying Ling 6 sounds, and identifying environmental sounds was highly variable.

*** The above information was shared by the UNC team.

The Cleveland Clinic

- Recommends daily intentional therapy activity that force isolation of the implanted ear (e.g., via wireless streaming) for at least the first 3-6 months following implantation.
- Anecdotal evidence suggests that patients who commit to an auditory therapy regimen that stresses listening with the implanted side progress further and faster than counterparts who do not.

Resources

- You will need a protocol to follow when developing listening skills. There are many available. We often use the Auditory Learning Guide and the SPICE.
- We don't use automated programs so I can't advise on those. A free one that we hear about is Angel Sound.
- Med El has Soundscape. Advanced Bionics has The Listening Room. Cochlear Americas has their Communication Center.
- I'm happy to be a resource to you. I can be reached at carla@zimmermanspeech.com.