Speech Therapy Considerations and Concerns for Patients with SSD Who Receive a Cochlear Implant

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Agenda

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- Clinical trial with MED-EL
- Therapy protocol based on what we've learned so far
- Special considerations
- What questions remain

Disclosures

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- MED-EL sponsored study.
  - CAUTION: Investigational Device Exemption. Not an approved FDA indication.
  - Dr. Park receives research grant support from MED-EL Corporation.
  - Dr. Brown serves on the MED-EL surgical advisory board.

Introduction

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- 20 children ages 3.5-6.5
  - Two children who were older were implanted under compassionate use.
    - Ages 12 and 7 years with 2 years of reported deafness
- Varying etiologies: (i.e. EVA, CMV, Waardenburg Syndrome, head trauma, unknown)
- The duration of deafness varied and was unknown for 9 subjects.
- All had normal cognition and spoken language skills
- Two had articulation delays at the time of implant.

Procedures: Tracking Progress

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- An informal auditory skills tracking tool was developed using a hierarchy of auditory skills
- Baseline information on auditory skills was obtained at activation with the participants listening with both ears
- The CI ear was isolated using direct connect
- Checked progress by presenting stimuli to the CI ear at 2 wks, 5 wks, 3mos, 6mos, 9mos, and 12mos post-activation

Single Sided Deafness Aural Habilitation Tracking Tool

THE CHILDREN'S COCHLEAR IMPLANT CENTER AT UNC

Student Name:_____ Tester:_____ Date:_____

Goal	Results	
Slide 2. Identify Ling Six Sounds (pictures) Procedure: Place cards in front of child. For baseline review the sounds and corresponding pictures with good ear. Play each sound for the child. Child will point to the picture or name the object on the front of the picture. Allow 2 repetitions.	ah___ oo___ mm___ s___ sh___ e___	
Slide 3. Identify Environmental Sounds (pictures) Procedure: Place cards in front of child. Play each sound for the child. Child will point to the picture or name the object on the front of the picture. Allow 2 repetitions.	Baby crying___ Dog Barking___ Phone___ Siren___ Bird___	Car/Car horn___ Rain/Thunder Storm___ Microwave___ Music___ Door Opening/Closing___
Slide 4. Identify Songs/Nursery Rhymes (pictures) Procedure: Place cards in front of child. For baseline review the songs by playing a short clip of the song on the computer and pointing to corresponding pictures. Play each song for the child. Child will point to the corresponding picture. Allow 2 repetitions.	ABCs___ Itsy Bitsy Spider___ Wheels on the Bus___ If You're Happy___ Pat-A-Cake___	Hey Diddle Diddle___ Head Shoulders___ Humpty Dumpty___ Row Your Boat___ I'm a Little tea Pot___
Slide 5. Identify Familiar Stereotypic Phrases (pictures) Procedure: Place cards in front of child. Play each phrase for the child. Child will point to the picture. Allow 2 repetitions.	Sit down___ Close your eyes___ Time for bed___ Time to eat___ Turn off the light___	Throw it away___ Close the door___ Wash your hands___ Ewww dirty___ Clean up___
Slide 6. Answer Common Questions (no pictures) Tell child you are going to ask some questions. Prompt them to listen. Play questions. Allow up to 2 repetitions.	What is your name?_____ How old are you?_____	
Take out picture of three circles. Prompt them to listen. Play questions. Allow up to 2 repetitions.	What color are these?_____ How many are there?_____	
Take out picture of child in bed. Prompt them to listen. Play questions. Allow up to 2 repetitions.	What is that (point to the ball)?_____ What is he doing?_____ Where is the book?_____	
Take out picture of dog in tub. Prompt them to listen. Play questions. Allow up to 2 repetitions.	What is that (point to the duck)?_____ What is he doing?_____ Where is the ball?_____	

Slide 7. Speech Babble (no pictures) Instruct child to imitate what they hear. Play for child. Allow up to 2 repetitions.	1. /babababu/___ 2. /bibibobo/___ 3. /bobaboba/___ 4. /bibubibu/___ 5. /mamababa/___	6. /mimibibi/___ 7. /papababa/___ 8. /gugututu/___ 9. /bobogogo/___ 10. /tatapapa/___
Slide 8. Identify Words in Categories (no pictures) Tell child you are going to play a list of foods and they are to repeat what they hear. Allow up to 2 repetitions.	Apples___ Cereal___ Pizza___ Mac & Cheese___ Grapes___	Spaghetti___ Cracker___ Bread___ Ice-Cream___ Banana___
Tell child you are going to play a list of clothes and they are to repeat what they hear. Allow up to 2 repetitions.	Shirt___ Pants___ Hat___ Dress___ Jacket___	Pajamas___ Socks___ Skirt___ Bathing Suit___ Shoes___
Tell child you are going to play a list of animals and they are to repeat what they hear. Allow up to 2 repetitions.	Dog___ Tiger___ Crocodile___ Bird___ Giraffe___	Bear___ Snake___ Chicken___ Octopus___ Rabbit___
Slide 9. Identify Multisyllabic Words (no pictures) Tell child you are going to play a list of words and they are to repeat what they hear. Allow up to 2 repetitions.	Table___ Balloon___ Flower___ Water___ Cookie___	Happy___ Airplane___ Little___ Window___ Blanket___	Hospital___ Bicycle___ Together___ Saturday___ Butterfly___	Ladybug___ Hamburger_ Elephant___ Medicine___ Remember_
Slide 10. Answer questions about a story with the topic disclosed (no pictures) Procedure: Tell the child the title of the story. Play the story for the child. Play the questions. Allow up to 2 repetitions of questions.	**The Naughty Dog** Mom put the chicken on the table for dinner. She went outside to get the mail. Our dog came in and smelled the chicken. He jumped on the table and ate it!	Q1.What did Mom put on the table?_____ Q2. Where did Mom go?_____ Q3. Who ate the chicken?_____
Answer questions about a story with the topic undisclosed (no picture) Procedure: Do not tell the child the title of the story. Play the story for the child. Play the questions. Allow up to 2 repetitions of questions.	**Our Trip to the Zoo** On Tuesday, our class is going on a trip to the zoo. We will go see the snakes and lizards. We will ride on a train and see the giraffes and lions. Then we'll eat lunch near the butterfly garden and play on the playground.	Q1. When did the class go to the zoo?_____ Q2. What did they see?_____ Q3. Where did they eat lunch?_____

Developed by Sandra Hancock, M.S., CCC-SLP, LSLS Cert. AVT & Maegan Evans, PhD, CCC-SLP, Cert AVEd

Romanik, S. (1990). Auditory Skills Program for Students with Hearing Impairment. Special Education & Focus Programs Division NSW Department of School Education.

Walker, B. (2016, September 15). Auditory Learning Guide. Hearing First.

Ling, D. (2002). Speech and the Hearing-Impaired Child: Theory and Practice 2nd edition (2nd ed.). AG Bell.

Procedures: Therapy

- Intervention program focusing on isolating the CI ear
- Children received therapy for the first 12 mos
  - Every other week for the first 6 mos
  - Once per month for the 2nd 6 mos
- Therapy setting – in clinic or teletherapy
- Home carryover

Isolating the Implanted Ear

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- Plugging the normal hearing ear: Not enough attenuation to completely block sound.
- Masking noise in the normal hearing ear: Can cause central masking and make therapy way too challenging.
- ISOLATE THE EAR BY STREAMING AND DIRECT CONNETIONS!
  - Determine which accessories are available with child's processor to take sound from a computer to their ear.

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Polling Question

?

Wireless Transmitters

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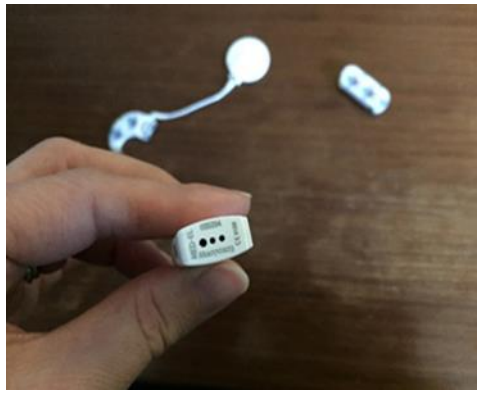
- Roger Pen

- Roger Select

- Roger Touchscreen Mic

MED-EL Equipment Set-Up: Connecting to Computer or Tablet Using Cable



- Put the FM sleeve on the processor.

- Use 90/10 adapter cable to plug into the FM sleeve on processor and then into headphone jack of a phone, computer or tablet.

Equipment Set-Up: Connecting to Computer or Tablet with Wireless Transmitter

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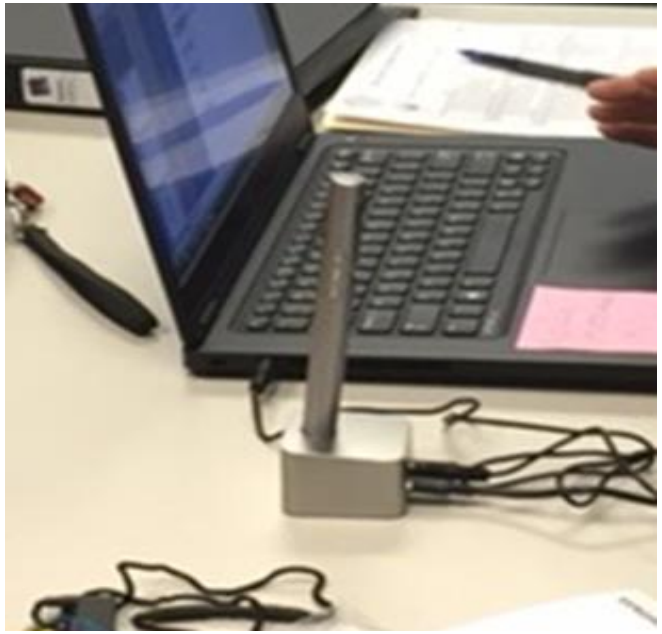
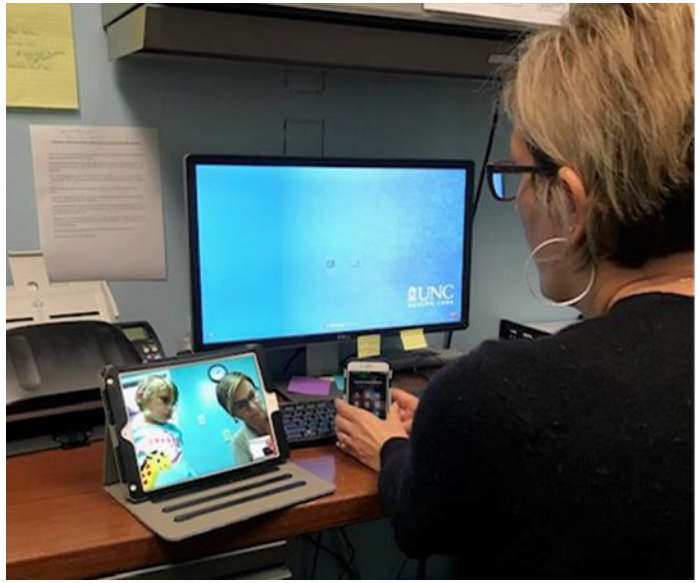


- Synchronize the transmitter to the child's processor.
- Use auxiliary cable to plug into the bottom of the Roger Pen (transmitter) or the charger with Roger Pen inserted, then into the headphone jack of computer/tablet.

Therapy Set-Up In-Clinic with Parent



- Clinician goes to another room with tablet or computer and a cell phone. Select a room far enough away so that the child cannot hear the clinician through the walls with his/her normal hearing ear.
- Parent stays in the room with the child.

Therapy Set-Up In-Clinic with Parent

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Child is connected to the tablet or computer by synchronizing the transmitter with the processor (seen on the left).

OR

Directly plugging in using a 90/10 adapter cable with MED-EL device (seen on the right).

Therapy Set-Up In-Clinic with Parent

- Parent & child join a video-conference with the clinician (ex. FaceTime, WebEx, Zoom).
- Parent and clinician connect by cell phone. Parent plugs headphones into their cell phone.
- Parent must mute mic on cell phone.

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Therapy Set-Up In-Clinic With Parent

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Home Carryover

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Set up similar to in-clinic with two caregivers/adults/older siblings.

OR

Play pre-recorded stimuli appropriate for the child's skill level through their CI for input, or to have them identify from a given closed set available to the child.

Skills Developed

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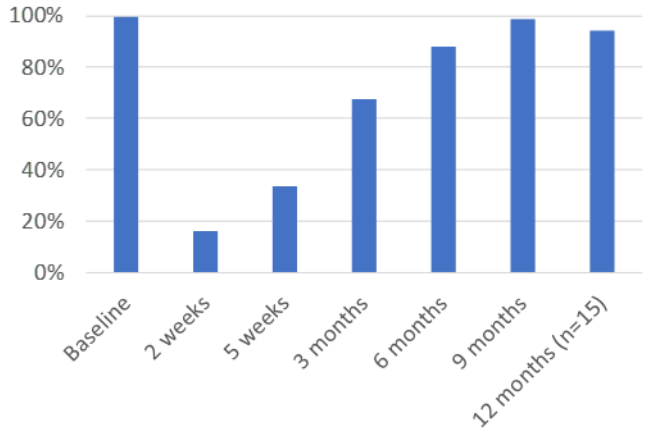
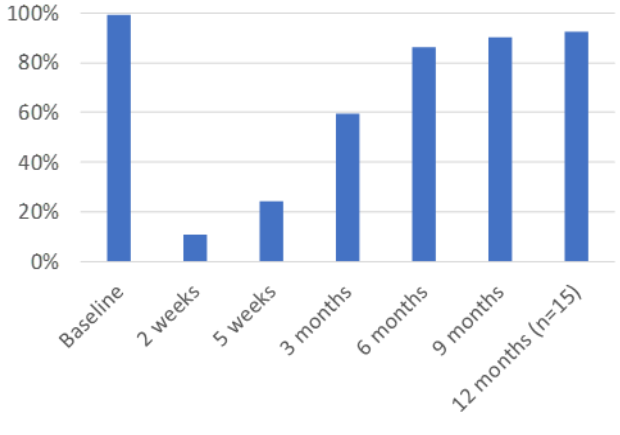
- Trend for improvement in all skills between 2 weeks – 9mos post CI
  - Progress began to taper off around 9mos
- Most children developed the ability to identify songs, stereotypic phrases, answer common questions from a closed set, and identify words from categories by 6 mos post CI
- Most were able 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

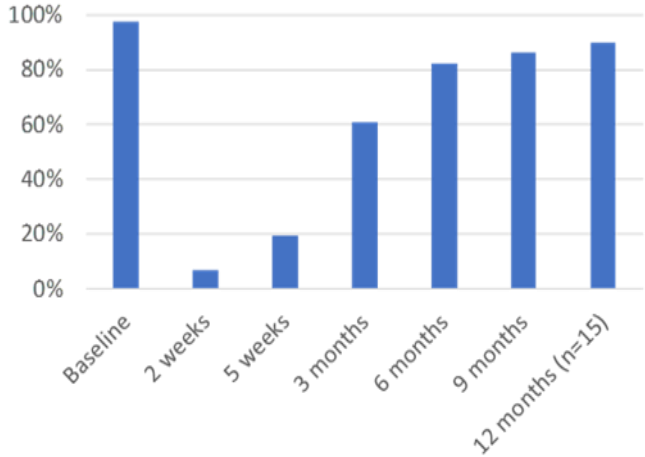
Songs



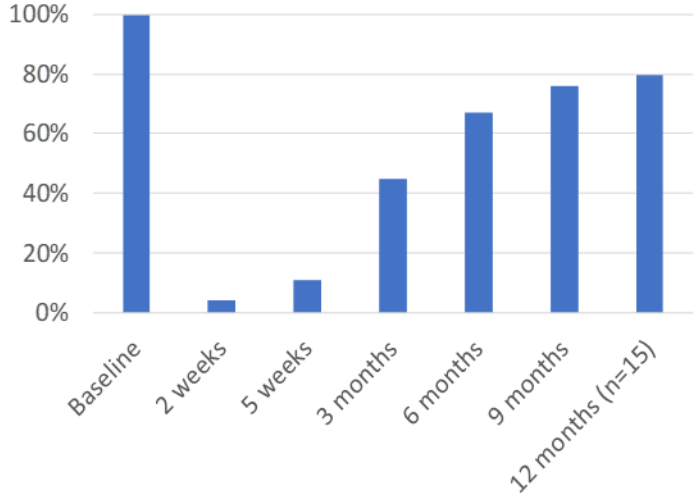
Stereotypic Phrases



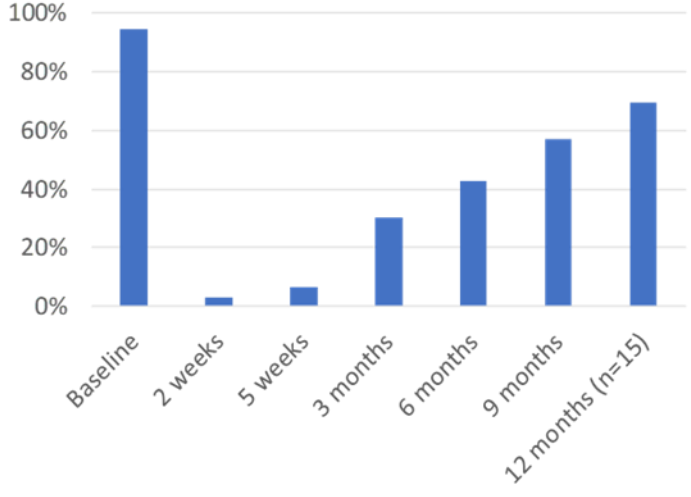
Common Questions



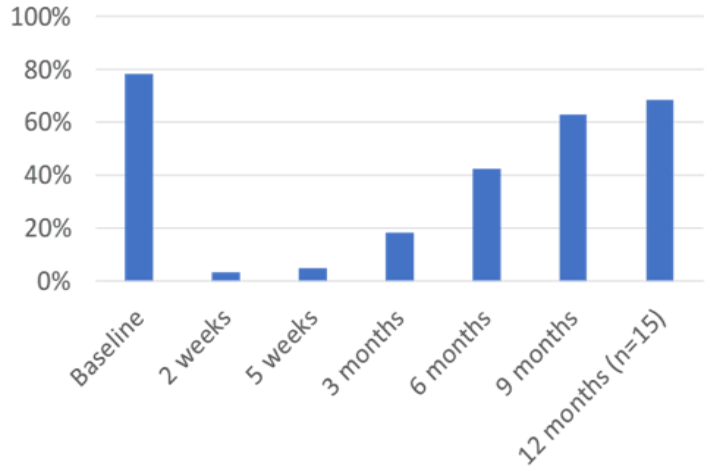
Categories



Multisyllable Words



Answering Questions About a Story: Topic Disclosed



Study Publications

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- Brown KD, Dillon MT, Park LR. 2021. Benefits of cochlear implantation in childhood unilateral hearing loss (CUHL Trial). Laryngoscope. [Published Online Ahead of Print]. DOI: 10.1002/lary.29853.
- Lopez EM, Dillon MT, Park LR, Rooth MA, Richter ME, Thompson NJ, O'Connell BP, Pillsbury HCP, Brown KD. 2021. Influence of cochlear implant use on perceived listening effort in adult and pediatric cases of unilateral and asymmetric hearing loss. Otol Neurotol. [Published Online Ahead of Print]. DOI: 10.1097/MAO.0000000000003261.
- Park LR, Dillon MT, Buss E, O'Connell B, Brown KD. 2021. Spatial release from masking in pediatric cochlear implant recipients with single-sided deafness. Am J Audiol. 26: 1-9. [Published Online Ahead of Print]. DOI: 10.1044/2020_AJA-20-00119.
- Park LR, Preston E, Noxon SA, Dillon MT. 2021. Comparison of test methods to assess the implanted ear alone for pediatric cochlear implant recipients with single-sided deafness. Cochlear Implants Int. 24: 1-8. [Published Online Ahead of Print]. DOI: 10.1080/14670100.2021.1903715.

Patients Outside of the MED-EL Study

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- We now have numerous recipients who were not part of the MED-EL clinical trial
- Varying in ages from 6 mos to 16 yrs
  - 6mo old had meningitis; 16yr old experienced sudden loss
- Expectations are different than those for children with bilateral loss
- Therapy recommendations differ from those for bilateral CI recipients or children with bilateral hearing loss

Therapy Protocol

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- For children ages 3-4 yrs +
- Goal for 1st 9 weeks post-activation is to achieve full-time device use and move through programs
- At 9 wk mapping teach parents how to set up direct connect using accessories in their kit
- Encourage parents to do some direct connect practice at home (familiar auditory info) before first therapy session
- Initial sessions focus on teletherapy set-up and INPUT of familiar auditory stimuli

Remote Mic Technology

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Streaming Technology

MED-EL
AudioStream

Nucleus
Smart App

Kanso 2

N 7 Processor

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Therapy Protocol

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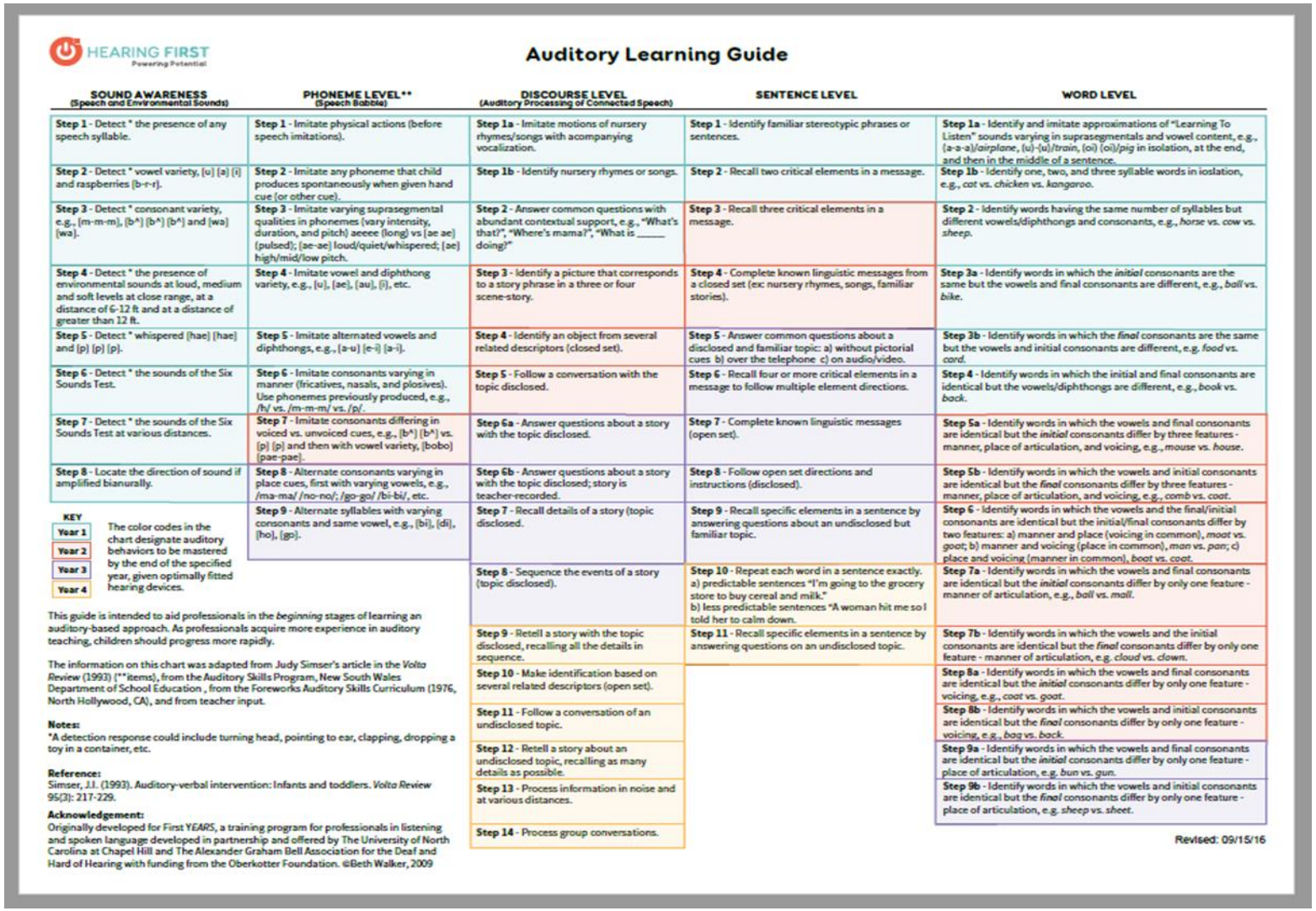

HEARING FIRST
Powering Potential

Auditory Learning Guide

SOUND AWARENESS (Speech and Environmental Sounds)	PHONEME LEVEL** (Speech Babble)	DISCOURSE LEVEL (Auditory Processing of Connected Speech)	SENTENCE LEVEL	WORD LEVEL
Step 1 - Detect * the presence of any speech syllable.	**Step 1** - Imitate physical actions (before speech imitations).	**Step 1a** - Imitate motions of nursery rhymes/songs with accompanying vocalization.	**Step 1** - Identify familiar stereotypic phrases or sentences.	**Step 1a** - Identify and imitate approximations of "Learning To Listen" sounds varying in suprasegmentals and vowel content, e.g., (a-a-a)/*airplane*, (u)-(u)/*train*, (oi) (oi)/*pig* in isolation, at the end, and then in the middle of a sentence.
Step 2 - Detect * vowel variety, (u) (a) (i) and raspberries (b-r-r).	**Step 2** - Imitate any phoneme that child produces spontaneously when given hand cue (or other cue).	**Step 1b** - Identify nursery rhymes or songs.	**Step 2** - Recall two critical elements in a message.	**Step 1b** - Identify one, two, and three syllable words in isolation, e.g., *cat* vs. *chicken* vs. *kangaroo*.
Step 3 - Detect * consonant variety, e.g., (m-m-m), (b^) (b^) (b^) and (wa) (wa).	**Step 3** - Imitate varying suprasegmental qualities in phonemes (vary intensity, duration, and pitch) aeeee (long) vs (ae ae) (pulsed); (ae-ae) loud/quiet/whispered; (ae) high/mid/low pitch.	**Step 2** - Answer common questions with abundant contextual support, e.g., "What's that?", "Where's mama?", "What is _____ doing?"	**Step 3** - Recall three critical elements in a message.	**Step 2** - Identify words having the same number of syllables but different vowels/diphthongs and consonants, e.g., *horse* vs. *cow* vs. *sheep*.
Step 4 - Detect * the presence of environmental sounds at loud, medium and soft levels at close range, at a distance of 6-12 ft and at a distance of greater than 12 ft.	**Step 4** - Imitate vowel and diphthong variety, e.g., (u), (ae), (au), (i), etc.	**Step 3** - Identify a picture that corresponds to a story phrase in a three or four scene-story.	**Step 4** - Complete known linguistic messages from a closed set (ex: nursery rhymes, songs, familiar stories).	**Step 3a** - Identify words in which the *initial* consonants are the same but the vowels and final consonants are different, e.g., *ball* vs. *bike*.
Step 5 - Detect * whispered (hae) (hae) and (p) (p) (p).	**Step 5** - Imitate alternated vowels and diphthongs, e.g., (a-u) (e-i) (a-i).	**Step 4** - Identify an object from several related descriptors (closed set).	**Step 5** - Answer common questions about a disclosed and familiar topic: a) without pictorial cues b) over the telephone c) on audio/video.	**Step 3b** - Identify words in which the *final* consonants are the same but the vowels and initial consonants are different, e.g. *food* vs. *card*.
Step 6 - Detect * the sounds of the Six Sounds Test.	**Step 6** - Imitate consonants varying in manner (fricatives, nasals, and plosives). Use phonemes previously produced, e.g., /h/ vs. /m-m-m/ vs. /p/.	**Step 5** - Follow a conversation with the topic disclosed.	**Step 6** - Recall four or more critical elements in a message to follow multiple element directions.	**Step 4** - Identify words in which the initial and final consonants are identical but the vowels/diphthongs are different, e.g., *book* vs. *back*.
Step 7 - Detect * the sounds of the Six Sounds Test at various distances.	**Step 7** - Imitate consonants differing in voiced vs. unvoiced cues, e.g., (b^) (b^) vs. (p) (p) and then with vowel variety, (bobo) (pae-pae).	**Step 6a** - Answer questions about a story with the topic disclosed.	**Step 7** - Complete known linguistic messages (open set).	**Step 5a** - Identify words in which the vowels and final consonants are identical but the *initial* consonants differ by three features - manner, place of articulation, and voicing, e.g., *mouse* vs. *house*.
Step 8 - Locate the direction of sound if amplified bianurally.	**Step 8** - Alternate consonants varying in place cues, first with varying vowels, e.g., /ma-ma/ /no-no/; /go-go/ /bi-bi/, etc.	**Step 6b** - Answer questions about a story with the topic disclosed; story is teacher-recorded.	**Step 8** - Follow open set directions and instructions (disclosed).	**Step 5b** - Identify words in which the vowels and initial consonants are identical but the *final* consonants differ by three features - manner, place of articulation, and voicing, e.g., *comb* vs. *coat*.
	Step 9 - Alternate syllables with varying consonants and same vowel, e.g., [bi], [di], [ho], [go].	**Step 7** - Recall details of a story (topic disclosed.	**Step 9** - Recall specific elements in a sentence by answering questions about an undisclosed but familiar topic.	**Step 6** - Identify words in which the vowels and the final/initial consonants are identical but the initial/final consonants differ by two features: a) manner and place (voicing in common), *moat* vs. *goat*; b) manner and voicing (place in common), *man* vs. *pan*; c) place and voicing (manner in common), *boat* vs. *coat*.
		Step 8 - Sequence the events of a story (topic disclosed).	**Step 10** - Repeat each word in a sentence exactly. a) predictable sentences "I'm going to the grocery store to buy cereal and milk." b) less predictable sentences "A woman hit me so I told her to calm down.	**Step 7a** - Identify words in which the vowels and final consonants are identical but the *initial* consonants differ by only one feature - manner of articulation, e.g., *ball* vs. *mall*.
		Step 9 - Retell a story with the topic disclosed, recalling all the details in sequence.	**Step 11** - Recall specific elements in a sentence by answering questions on an undisclosed topic.	**Step 7b** - Identify words in which the vowels and the initial consonants are identical but the *final* consonants differ by only one feature - manner of articulation, e.g. *cloud* vs. *clown*.
		Step 10 - Make identification based on several related descriptors (open set).		**Step 8a** - Identify words in which the vowels and final consonants are identical but the *initial* consonants differ by only one feature - voicing, e.g., *coat* vs. *goat*.
		Step 11 - Follow a conversation of an undisclosed topic.		**Step 8b** - Identify words in which the vowels and initial consonants are identical but the *final* consonants differ by only one feature - voicing, e.g., *bag* vs. *back*.
		Step 12 - Retell a story about an undisclosed topic, recalling as many details as possible.		**Step 9a** - Identify words in which the vowels and final consonants are identical but the *initial* consonants differ by only one feature - place of articulation, e.g. *bun* vs. *gun*.
		Step 13 - Process information in noise and at various distances.		**Step 9b** - Identify words in which the vowels and initial consonants are identical but the *final* consonants differ by only one feature - place of articulation, e.g. *sheep* vs. *sheet*.
		Step 14 - Process group conversations.		

KEY

Year 1
Year 2
Year 3
Year 4

The color codes in the chart designate auditory behaviors to be mastered by the end of the specified year, given optimally fitted hearing devices.

This guide is intended to aid professionals in the *beginning* stages of learning an auditory-based approach. As professionals acquire more experience in auditory teaching, children should progress more rapidly.

The information on this chart was adapted from Judy Simser's article in the *Volta Review* (1993) (**items), from the Auditory Skills Program, New South Wales Department of School Education , from the Foreworks Auditory Skills Curriculum (1976, North Hollywood, CA), and from teacher input.

Notes:
*A detection response could include turning head, pointing to ear, clapping, dropping a toy in a container, etc.

Reference:
Simser, J.I. (1993). Auditory-verbal intervention: Infants and toddlers. *Volta Review* 95(3): 217-229.

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Originally developed for First *YEARS*, a training program for professionals in listening and spoken language developed in partnership and offered by The University of North Carolina at Chapel Hill and The Alexander Graham Bell Association for the Deaf and Hard of Hearing with funding from the Oberkotter Foundation. ©Beth Walker, 2009

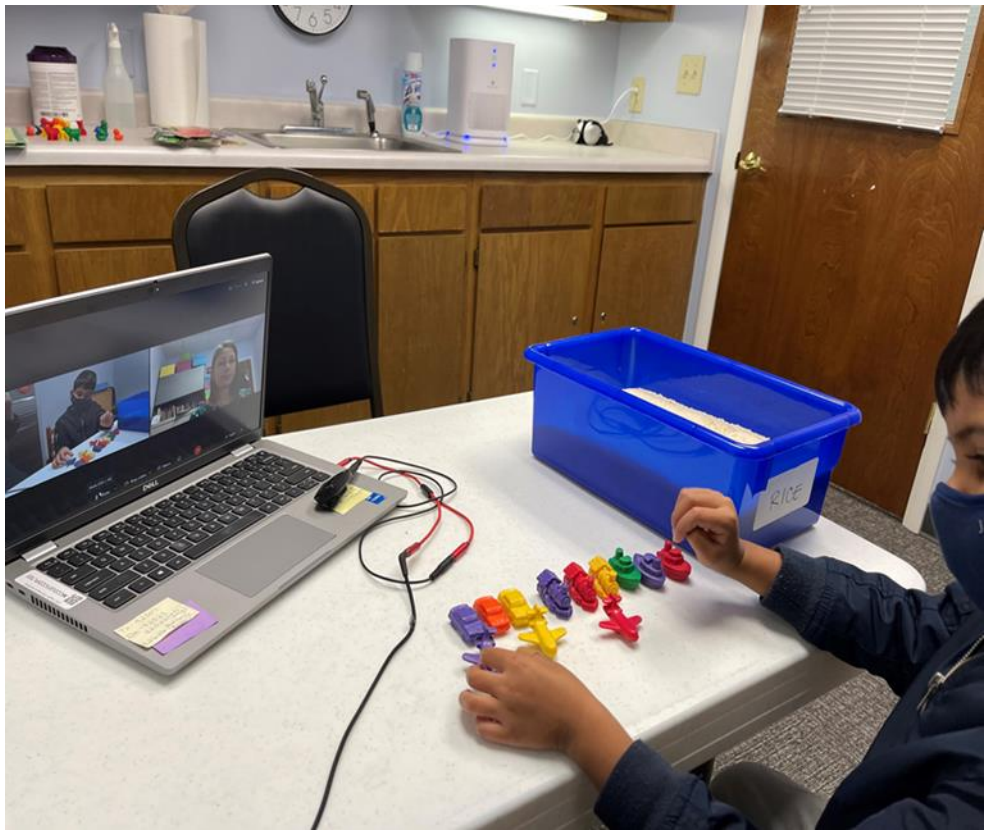
Revised: 09/15/16

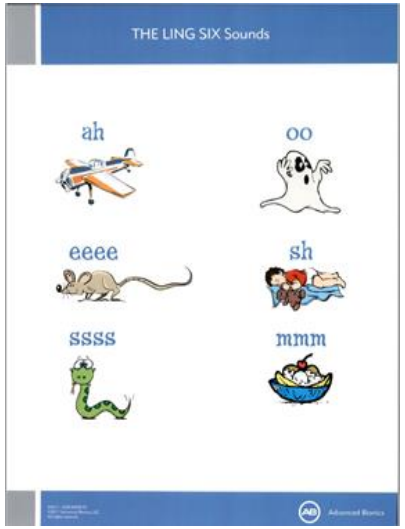
Therapy Protocol

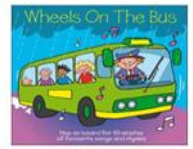
Early goals to address in a closed set include:

- Input/identification of Ling six sounds
- Input/identification of familiar songs
- Input/identification of phrases and answering common questions
- Input/identification of Learning to Listen Sounds
- Input/identification of 1, 2, 3 and 4 syllable words


Tx - 92507
Dx - 92523 (only)
92522 (only)
92626 (only)







Yaaaaaay, I did it!

It's broken.

Be careful, it's hot!

OUCH! That hurts!

A cookie, mmmmmmmmm

The airplane goes ahhhhhhhh

The rabbit goes hop hop hop hop

Baby is sleeping, shhhhhhhhh

The cow says moooooooo

The sheep says baaaa baaaaa

The duck says quack quack

The horse says neigh

The monkey says oo oo ee ee

The snake says sssssssssss

The dog says woof woof

The cat says meow

The car goes brrrrrrrr, beep beep

The train goes choo choo

Tweak

Peso

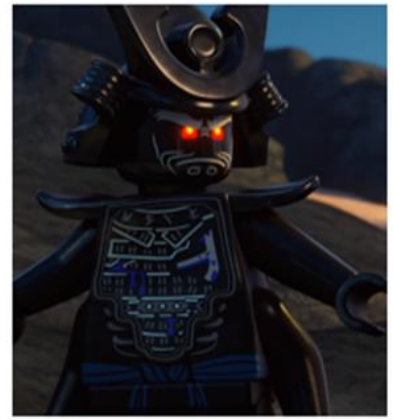
Shellington

Professor Inkling

Kai

Nya

Sensai Wu



Lord Garmadon


UNC
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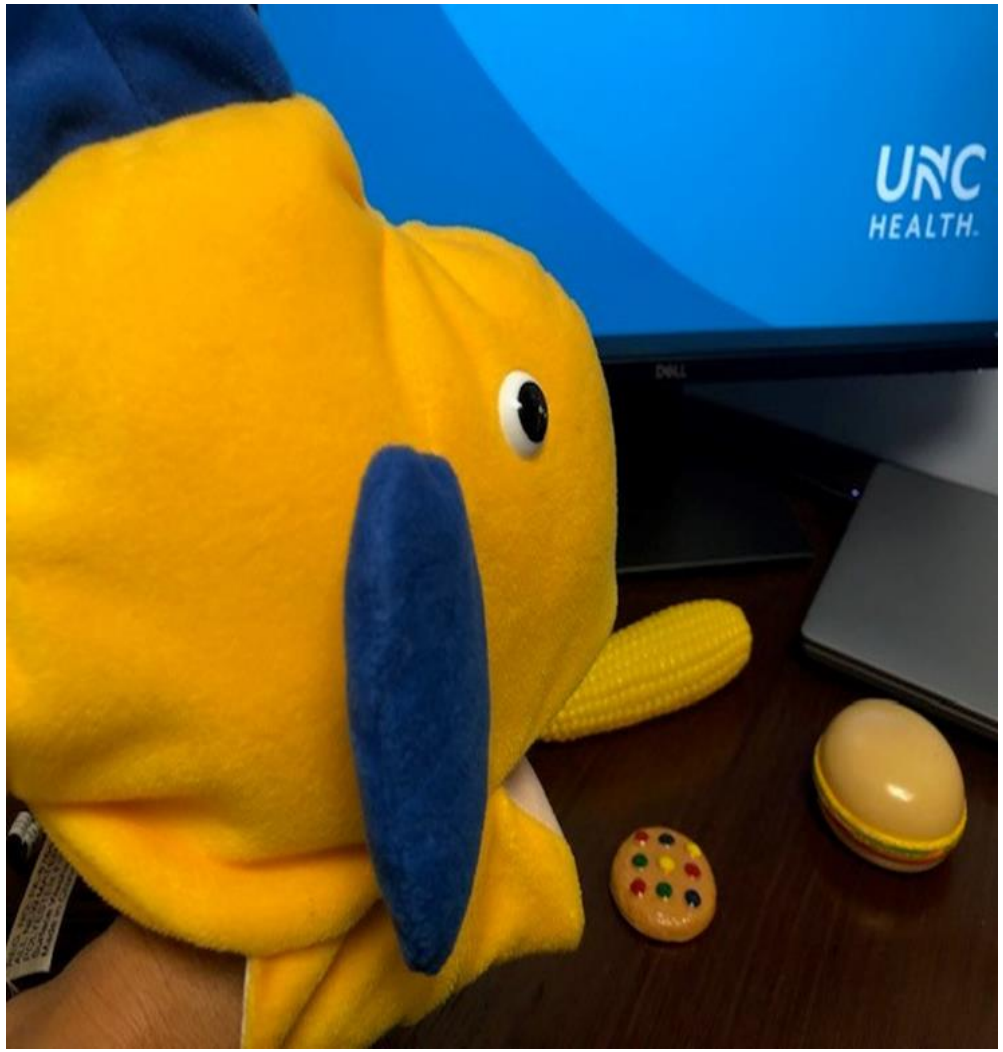
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Therapy Protocol

Once the child has demonstrated mastery of the above goals, increasing the complexity of goals is next:

- Identification of objects from several related descriptors
- Imitating Predictable Sentences (Let's go play outside, She forgot to bring her lunch)
- Answering questions about a story with the topic disclosed
- Identification of words within a category (Category: animals,desserts, furniture, Halloween words…)
- Minimal Pair Words with final consonants and vowels the same, but initial consonant is different in manner (hat/cat) or voicing (bear/pear)

Therapy Protocol

Lastly, more advanced goals with increased information within an open set:

- Identifying absurdities (The sun shines at night)
- Retelling details of a five sentenced story in sequence
- Minimal Pair Words with final consonants and vowels the same, but initial consonants differ by place (boat/goat).

Special Considerations

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- Often kids will report that they can't hear. This typically does not mean that they hear silence; rather they can't understand what they're hearing or recognize the signal as speech.
- Using a wireless transmitter outside the room results in an intermittent signal going to the child's CI
- Bluetooth can be glitchy
- The CI outreach representative and audiologist can be helpful in technology set-up.

Special Considerations

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- WEAR TIME
- Target speech & language goals using both ears
- Child might not notify adult if processor is not working
- Benefits not measured same as with bilateral CI users (speech in noise, localization & reduced fatigue rather than speech perception)
- Children tend to fatigue quickly when beginning listening through direct connect – 15-30 min sessions tend to be all they can handle
- Good internet connection is crucial

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Polling Question

?

Additional Goals

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- Activities to target localization
  - Play hide & seek around the house and call to the child as they are searching for you
  - Hide your cell phone and make it ring, then let the child try to find it while listening to the ringing
  - Sit behind child and play noisemakers on either side; have child point to direction they heard the sound coming from
- Activities for listening in noise
  - Practice goals mastered through direct connect, while listening with both ears in the presence of background noise
  - Play white noise, single speaker babble, then multi-talker babble on cell phone nearby

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Case Examples

Neena,
5 years old

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Background Information

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Congentital HL; diagnosed at age 4yrs

Mild loss rising to normal in right ear

Profound loss in the left ear

Normal inner ear structure and present auditory nerves

Cause of HL unknown

Received left CI at age 4yrs, 9**mos**

Background Information

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- Speech & language scores pre-CI:

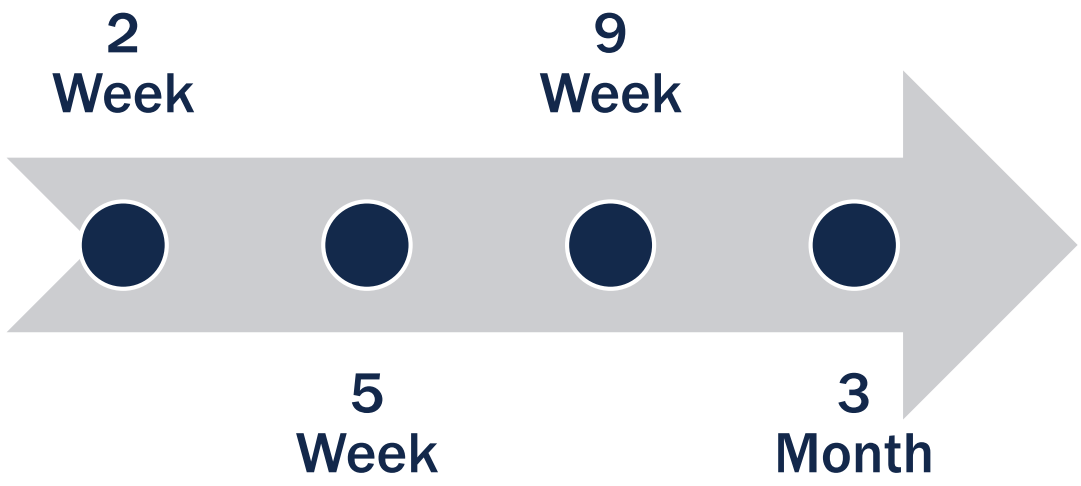
Oral and Written Language Scales-Second Edition (OWLS-II): This tests understanding and use of language for children and young adults aged 3 through 21 years. Scores between 85 and 115 are considered normal.

	Standard Score	Percentile Rank	Severity Rating
Listening Comprehension	103	58	Within normal limits
Oral Expression	92	30	Within normal limits
Oral Composite	96	39	Within normal limits

Goldman-Fristoe Test of Articulation (GFTA-3): This test is administered to assess a child's phoneme production in single words. Standard scores are based on a mean of 100 and standard deviation of 15. Scores between 85 and 115 are considered within normal limits.

Standard Score	Percentile Rank	Severity Rating
85	18	low average

Post CI Audiology



2 Week: Hearing Hours Percentage (HHP) 62.5% & reporting that CI sounds like “beep beep boop boop tsk tsk”

5 Week: Parents reported patient is more aware of the direction of sound and notices that she is asking “where are you?” less.

9 Week: parents reported patient now says she can “hear” them instead of reporting hearing beeps and sounds; weekly teletherapy began

3 Month: HHP=65%; parents reported improvements listening in noise

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Treatment/Intervention

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- 5mos post CI - through direct connect listening Neena was able to:
  - Imitate Ling 6 sounds
  - Identify familiar songs
  - Identify words within a given category

- 5mos post-CI updated speech & language testing demonstrated significant improvements:

Oral and Written Language Scales-Second Edition (OWLS-II): This tests understanding and use of language for children and young adults aged 3 through 21 years. Scores between 85 and 115 are considered normal.

	Standard Score	Percentile Rank	Severity Rating
Listening Comprehension	111 (103)	77 (58)	Within normal limits
Oral Expression	113 (92)	81 (30)	Within normal limits
Oral Composite	111 (96)	77 (39)	Within normal limits

Goldman-Fristoe Test of Articulation (GFTA-3): This test is administered to assess a child's phoneme production in single words. Standard scores are based on a mean of 100 and standard deviation of 15. Scores between 85 and 115 are considered within normal limits.

Standard Score	Percentile Rank	Severity Rating
109 (85)	73 (18)	Within normal limits

Treatment/Intervention

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- Continued progress with speech recognition through direct connect listening with her CI only:
  - identify words w/in given category – 100% accuracy
  - follow open set directions – 100% accuracy
  - follow conversation with topic disclosed

- Dismissed from therapy after 6 mos, with recommendation to continue full-time CI use all waking hours

Dallas, 3 Years Old

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Background Information

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Passed NBHS in right ear; failed in left ear

Behavioral testing typical hearing right and severe-profound loss in the left

MRI revealed normal inner ear structure and present auditory nerves

Cause of HL unknown

Received left CI at age 2yrs, **7mos**

Background Information

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Preschool Language Scales-5th Edition	Standard Score	Percentile Rank	Severity Rating
Auditory Comprehension	103	58	Within Normal Limits
Expressive Communication	103	58	Within Normal Limits
Total Language Score	103	58	Within Normal Limits

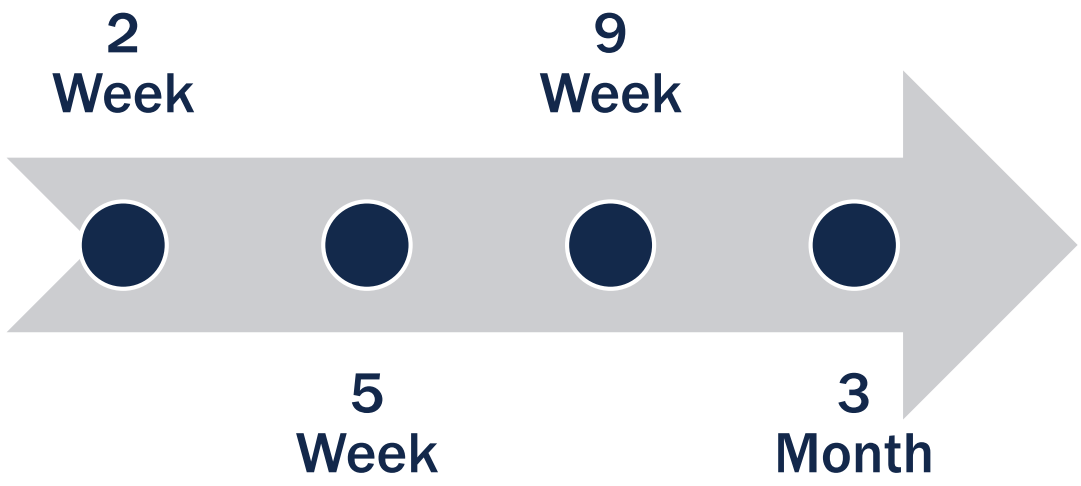
Background Information

UNC SCHOOL OF MEDICINE

Identifying Early Phonological Needs Test in Children with Hearing Impairment (IEPN):

Word Patterns	92%
Syllables	80%
Stress	80%
IC	100%
FC	94%
Vowels	90%
Diphthongs	73%
Manner	70%
Place	67%
Voicing	93%

Post CI Audiology



2 Week: HHP 77.6%, increased sound awareness, noticing new sounds

5 Week: HHP 58.5%, told teacher CI was not working at school

9 Week: HHP 55.4%, with direct connect noticing music, but not what song

3 Month: HHP 44%, giving information on volume of sound with CI only

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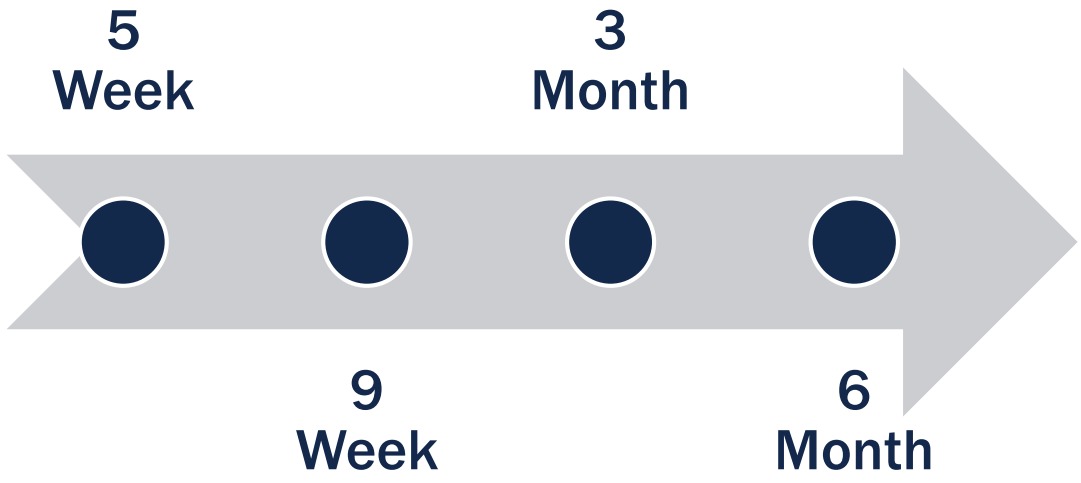
Treatment/Intervention



5 Week: began bi-monthly tele-therapy

9 Week: increased tolerance to CI alone practice

3 Month: identifying some Ling Six, beginning id songs and phrases

6 Month: "Wow mommy, the sounds. They're in my implant, it's working"

Joshua,
6 years old

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Background Information

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Placed in foster care at age 3.5yrs; foster mother reported known medical history was brief

Born premature – unknown how early

Spent some time in NICU – possibly NAS symptoms

NBHS – passed in left; referred in right

Natural sleep ABR indicated normal hearing in left ear; at least severe loss in right ear

Lost to follow up

Background Information

UNC SCHOOL OF MEDICINE

Referred to UNC Pediatric Audiology, by PCP, due to speech delay at age 4yrs

Foster parents reported that he speaks very loudly, is impulsive, and hyperactive

Behavioral testing revealed normal hearing in left ear, but fatigued to testing and could not obtain thresholds in the right ear

Sedated ABR & MRI recommended

Foster parents working with county school system to develop IEP & access support services – process disrupted by COVID

Background Information

UNC SCHOOL OF MEDICINE

MRI revealed normal hearing anatomy

Sedated ABR revealed normal hearing in left ear; no response in right ear

Referred to CI center

Received CI in right ear at 5yrs, 5mos

Background Information

UNC SCHOOL OF MEDICINE

- Speech & language scores pre-CI:

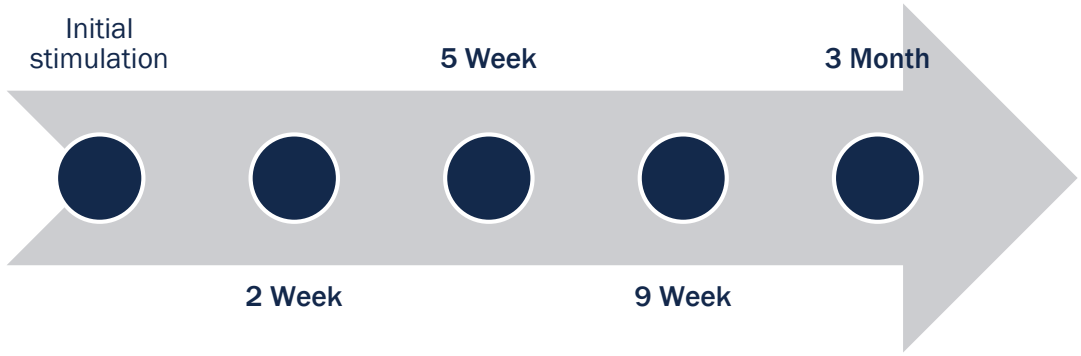
Oral and Written Language Scales-Second Edition (OWLS-II): This tests understanding and use of language for children and young adults aged 3 through 21 years. Scores between 85 and 115 are considered normal.

	Standard Score	Percentile Rank	Severity Rating
Listening Comprehension	84	14	Within normal limits
Oral Expression	110	75	Within normal limits
Oral Composite	96	39	Within normal limits

Goldman-Fristoe Test of Articulation (GFTA-3): This test is administered to assess a child's phoneme production in single words. Standard scores are based on a mean of 100 and standard deviation of 15. Scores between 85 and 115 are considered within normal limits.

Standard Score	Percentile Rank	Severity Rating
87	19	low average

Post CI Audiology



Initial Stimulation: detected sound in CI and reported “too loud” at one point

2 Week: foster parents reported sound awareness clues from Joshua

5 Week: Joshua wearing his CI approximately 5hrs per day

9 Week: Joshua wants to wear his CI and asks for it; Weekly teletherapy began after this apt

3 Month: Joshua wearing his CI approximately 10hrs per day

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Treatment/Intervention

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- Weekly teletherapy began after 9 week mapping
- First two sessions foster mom was unable to connect to virtual visit; home internet not adequate; scheduled for internet upgrade
- First time participating in direct connect listening Joshua reported
  - “I can’t hear anything”
  - “I hear beeping” while listening to input of familiar songs
  - “I kind of hear it” while listening to input of Ling 6 sounds

Treatment/Intervention

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- Next several teletherapy sessions were inconsistent due to various reasons
- 6 mos post CI – Joshua wearing CI 11hrs per day
- Began identifying familiar songs & Learning to Listen Sounds from closed set through direct connect listening, but performance was inconsistent
- A couple more missed sessions; great difficulty attending & focusing during teletherapy sessions; inconsistent performance on listening tasks
- Take a break from teletherapy & direct connect listening

Therapy/Intervention

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- 9 mos post CI – SLP cotreat w/audiologist: Joshua continuing to wear CI 10-11hrs per day
- Joshua reporting “I need my CI” while at home; particularly in background noise
- Teachers reporting behavior at school significantly improved since receiving CI
- Discontinued teletherapy with the goal of continued full-time CI use

Questions that Remain

- How much direct connect therapy is needed?
- How much benefit do kids achieve without direct connect listening practice?
- How much practice with localization activities and listening in noise do kids need?
- Is therapy needed for young toddlers?



Thank you!