

The Benefits of Upgrading External Cochlear Implant (CI) Technology: Pediatric CI User Experiences & Professional Feedback

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Why Upgrade?

- Current processor is:
 - Out of warranty
 - Obsolete
 - Can no longer be repaired or replaced
- Improvements in technology and/or design
 - Speech understanding
 - Battery life
 - Connectivity
 - Smaller, better retention

What is a “Pediatric” Processor?

- Does not necessarily have to do with the device itself
 - Any processor can be a “pediatric” processor
- “Pediatric” = features that make a processor successful for a child
 - Retention/Style
 - Easy to Troubleshoot
 - Connectivity/Accessories
 - Programming

Change is Good... and Necessary

- While it can be difficult to think of making a change from one technology or style to another, keep in mind:
 - Children will continue to hear just as well
 - If anything, upgrading to new technology will improve their performance!
 - All 3 CI manufacturers allow for us to convert old programs/Maps to new processors
 - Families can test out new programs or features and compare them to old programs
 - At some point, technology will go obsolete and new technology will be warranted
- Some of what is available to our CI users today was unheard of even 10 years ago
 - Technology is always evolving
- We'd like to explore the pediatric features that are currently available and how parents and audiologists can work together to find solutions that work best for each individual child

Let's Talk About Retention

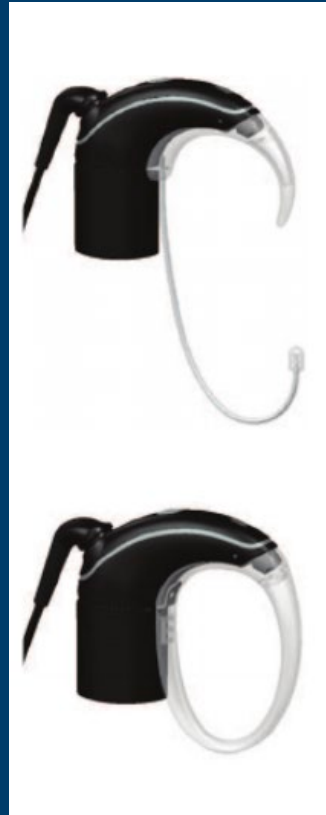
- A shared, primary goal of the audiologist and the family should be *FULL TIME* device use
 - If we cannot keep the processor on, then any other goal for the child will be impacted
- Among the 3 CI manufacturers, there are multiple external processors and different ways to modify the processors to stay in place
- It is difficult to predict what style will be best for each child
- Having multiple wearing options gives families more flexibility

Behind-the-Ear (BTE) Processor

- All 3 CI manufacturers have a BTE processor
 - Over the years, these processors have gotten slimmer and smaller to be able to fit more comfortably on smaller ears
- Benefits:
 - Keeps microphone “ear level”
 - Have the most flexibility when it comes to connectivity options
- Challenges:
 - Retention issues
 - Difficulty staying in place on smaller ears
 - Some children cannot tolerate anything sitting on their ears
 - More parts to troubleshoot

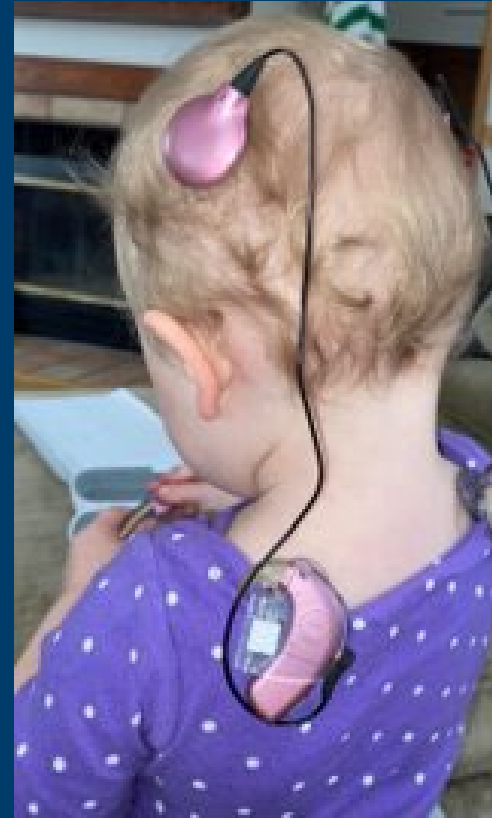
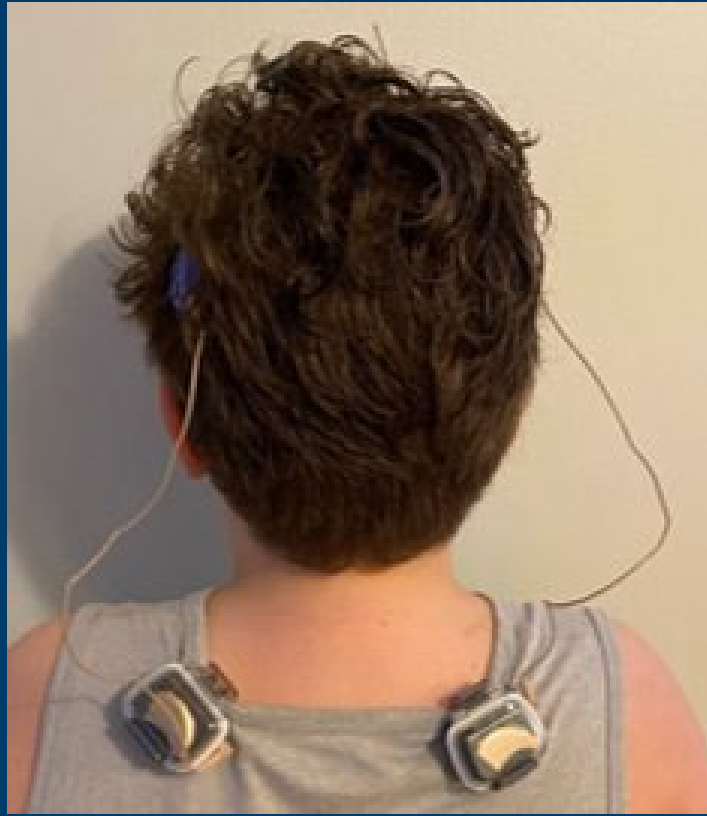


BTE Modifications



- Popular options:
 - Headband
 - Huggy/Huggie/HugFit
 - Retention Cuff/SnugFit
 - Earmold
- Keeps microphone ear-level
- Works well for those toddlers who are on the move or older children who just need the extra support

BTE Modifications: Body-Worn Option



- Removes the BTE processor from the ear
- All 3 manufacturers have body-worn options
- Challenges
 - Microphone placement
 - On the processor vs. on the headpiece
 - Might require changing the program
 - Longer cables increase possibility of a static event
 - Longer cables break more easily

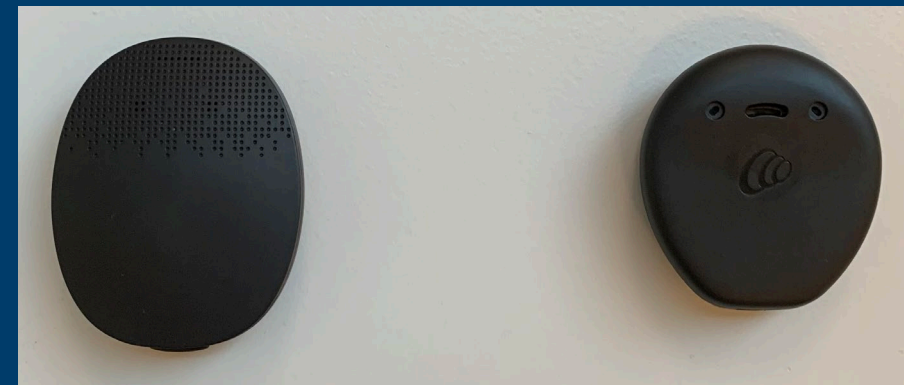
Off-The-Ear "Button" Processors

- Benefits

- Less pieces to manage
- Easier for young children to put back on their heads if it falls off*
- Rechargeable**

- Challenges

- *Sometimes children can put it back on themselves, but they may not get it in the correct position which could impact the signal and battery life
- **If rechargeable battery dies, need to take off and charge it
 - No disposable battery option
 - Can use portable charger battery pack
 - Battery life has not really been an issue with either of these processors though
- Thicker than the BTE coils
 - Can fall off more easily than BTE coil, especially in a car seat
- Heavier on the coil site
 - Fine balance of finding a magnet strength that keeps it on but also doesn't cause redness/swelling



Wearing Styles: Considerations

- Primary goal is to use the wearing style that will lead to the best retention for that child
 - What works for one child might not work for another
- If a parent is switching between different wearing styles, some processors will require using a different program to change the microphone location
- Tolerance/Child's Preference
 - If a child will tolerate one style with no resistance but throws a fit over another style – then let's not make this harder on ourselves – go with what works!
 - Child's preference may change over time
- Communication needs
 - Certain wearing styles can limit access to certain features
 - Remote Microphone technology
 - Speech-in-Noise settings
- While one style may be very appropriate and successful at one time in a child's life, another style could also work and open new possibilities

Upgrade Experience: Henry

17-year-old who went from a BTE to a smaller BTE to button processor with disposable batteries to a rechargeable button processor



He reports that his current button processor is the best processor he's ever had because of the ability to stream directly to his phone and its rechargeable battery

Connectivity/Accessories

- **Bluetooth connectivity**
 - Ability to stream videos, music and phone calls directly through the processor
 - Has been a big deal for online learning as patients were able to stream their classes from their tablet directly to their processors
 - Streaming to Bluetooth devices can often be a motivating factor for some children to wear their devices
 - All current processors have this ability
 - The pairing process varies among the companies
 - Some processors will require an additional accessory in order to stream
- **Waterproof capability**
 - Most processors still need a waterproof cover for extended use
- **Remote Microphones**
 - Parent/teacher ability to wear a microphone that directly streams to the processor for increased understanding in background noise or from a distance
 - All processors have the ability to work with a remote microphone, but there could be limitations to certain devices
- **Rechargeable batteries**
 - Battery life varies between manufacturers
 - Different battery sizes may be available
 - A smaller battery might mean shorter battery life (may need to replace in the middle of the day)

Upgrade Experience: Violet, 14 years old

- Bilaterally implanted for 9 years and primarily wore and preferred her body-worn processors
 - Her primary reason for loving her body-worn processors was because she insisted that they fit much better under her softball helmet
- She was very hesitant and resistant to giving up her body-worn processors and switching to a BTE style
 - Her body-worn processor was going obsolete, so she reluctantly agreed to upgrade her processors, but insisted she would be wearing the new processor in a body-worn style and not as a BTE
- At the upgrade appointment, we demonstrated how she could stream directly to her phone, and she was hooked
 - She even left wearing her processors as a BTE, but still insisted she'd be using her old body-worn processors for sports
- Upgrade follow-up:
 - It did take her some time to transition to the new processors full time, but once she did, she never went back
 - Her speech perception scores improved 20+% with the newer technology compared to her old, body-worn processors!
 - Also, the new BTE processors fit just fine under her helmet

Troubleshooting

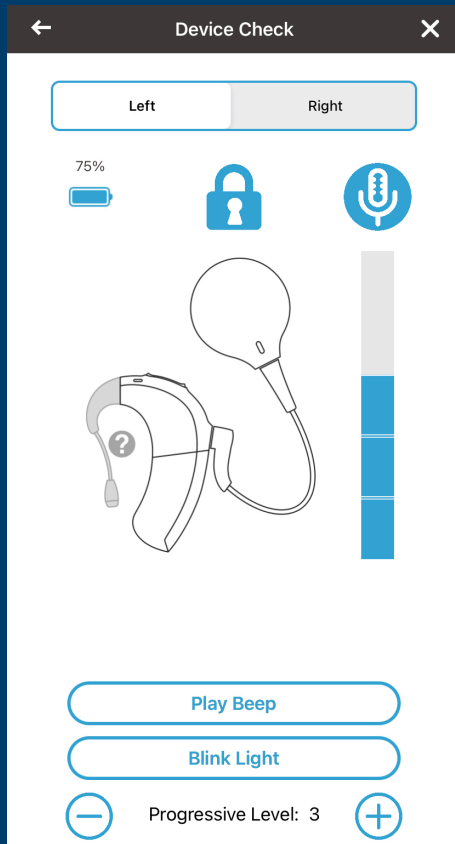
- The ability to troubleshoot issues with a processor is especially important for children who are not able to report if there is an issue
- Tools for Troubleshooting:
 - Indicator Lights/Beep Alerts
 - Lights can indicate that the processor is connected correctly or not
 - AB's waterproof battery has beep alerts if the coil falls off
 - Listening checks
 - Ability for parent/provider to listen to the clarity of the processor microphone
 - Datalogging
 - Provides an average of how many hours per day the processor is connected to the internal device
 - All current processors now have datalogging capability
 - Smartphone Apps

Smartphone Apps

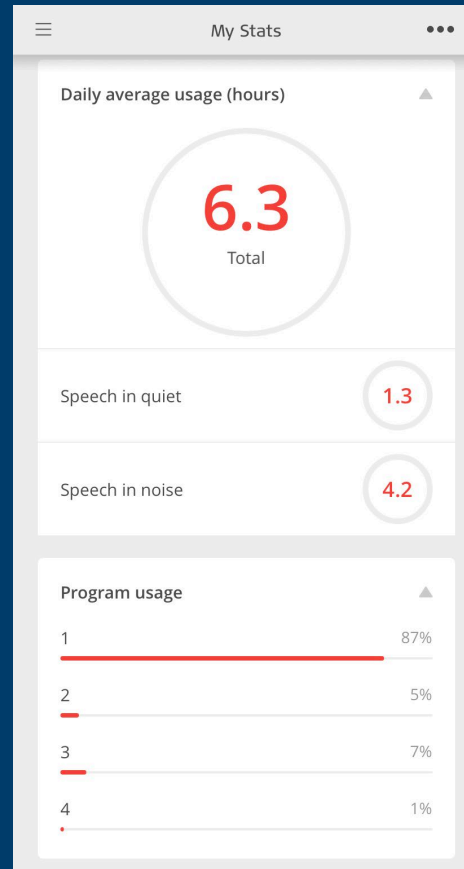
- All 3 manufacturers have smartphone Apps
 - Basic troubleshooting
 - Battery life
 - Microphone check
 - Coil connection
 - Datalogging
 - Family can track stats on their own
 - Can be helpful for parents if there is another caregiver looking after the child for extended periods of time
 - Track lost processor
 - Change programs
 - Progressively louder programs after initial activation
 - Programs are the same volume, but have different features enabled or disabled

Smartphone Apps

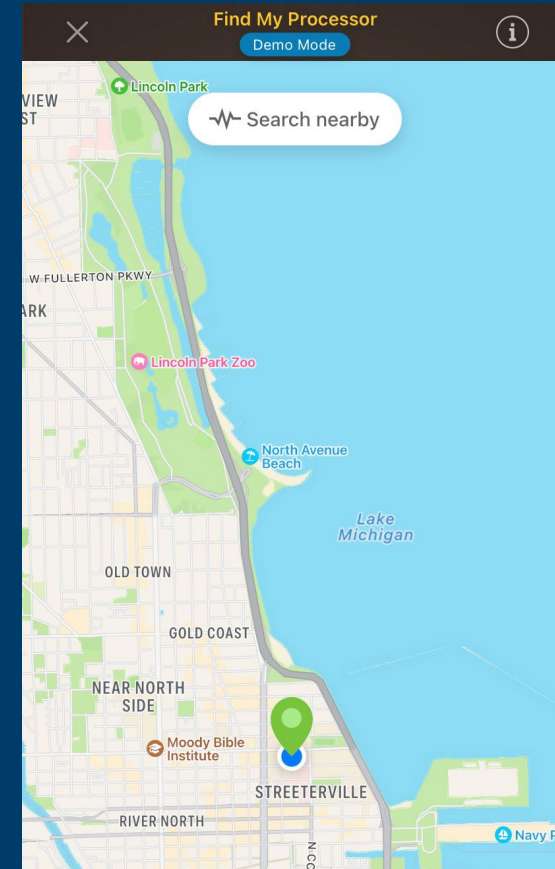
Troubleshooting



Track wear time



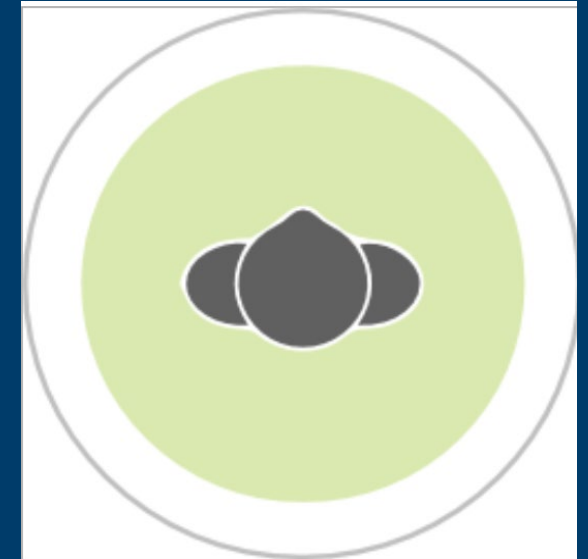
Locating lost processor



Programming Considerations

- Consider the child's typical environment, communication needs and ability to provide feedback
 - Quiet, one-on-one settings vs. noisier environments such as a classroom
- Typically, younger children spend their time in close contact with their caregivers in quieter settings
 - Primary goal is providing access to soft speech
 - Special features for background noise are typically disabled and microphones are programmed to pick up sound evenly from all directions (omnidirectional)
- Once children start entering preschool, it might be time to enable some advanced features
 - Comfort in noise
 - Audiologist can create different programs to test out the new noise programs

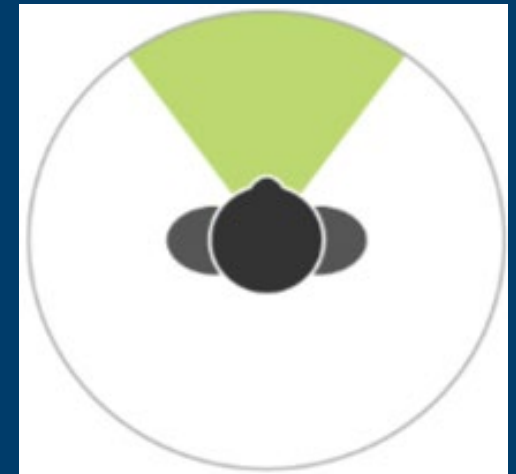
Omnidirectional



Programming Considerations

- Now let's think about those children that are:
 - Independent (not supervised by parent full time)
 - In more challenging listening environments like noisy classroom or gym class
 - Have opinions and feedback!
- Time to take advantage of those automatic/intelligent processing features available from the manufacturers
 - Processors can determine what type of environment the child is in and adapt the way the processor is working based on that environment
 - Understanding speech in noise
 - Omnidirectional --> Directional
 - Should only be enabled for children who are able to verbalize how they are hearing in certain situations
 - Home vs. Cafeteria vs. Classroom vs. Gym
- Certain wearing styles can limit access to certain features
 - Due to the location of the microphone placement, body-worn styles mean that the child will not be able to take advantage of the Automatic features that could improve understanding speech in noise

Directional



Upgrade Experience: Lauren, 19 years old

- Received bilateral upgrade in 2021
- Even though she's been implanted since before she turned 1, she's still experiencing new things
- Lauren's Comments:
 - One of the biggest changes was the sound clarity
 - The bluetooth feature is one of my favorite changes. As a student, I'm always either on my phone or computer and I use each with bluetooth interchangeably.
 - Overall, the equipment is lasting longer. The cables are structured and built so nicely—it's a small thing, but the way it fits on the head is a lot nicer than before and they last more months so far.
 - I use my autosense as my go-to. I tend to sit within the first 2 rows in classrooms so I do have to make the effort sometimes to turn my head to a person speaking behind me to hear better. That being said, I do like having different program options available to see on my phone.
- Lauren's Mom:
 - Lauren was able to hear a lot more sounds at a much lower volume
 - Even though her speech is amazing, the clarity and accuracy has been a remarkable improvement
 - With this upgrade, Lauren experienced almost no issues in class with masks - hearing, understanding and responding. There was a big difference between her last year of high school and first year of college even though masks were required both of the years - it was the upgrade that made the difference.

Final Thoughts

- As pediatric audiologists, there is rarely a recommendation we make that does not involve the parent's perspective and approval
 - We rely on the parent's feedback about their lifestyle and what works for their own child in order to make recommendations that will be successful for the child
 - Parents are the experts when it comes to their child
- While we as the audiologists do have the final say for the programming and might have our own "professional" opinion, ultimately, if it cannot be translated to the everyday life of the child and family, then what is the point?
- Collaboration with parents on how to get their young child to be successful with a CI is critical
 - We might be working together for the next 20+ years

Podcast by Lurie Children's Audiology



Amplified: Presented by Lurie Children's is a podcast mini-series about growing up with hearing loss. Katie Radesevich already demonstrated a speech and language delay when she was identified with a significant hearing loss at 2.5-years-old. Listen to Katie and her family share the journey from pre-diagnosis to Katie's current incredible accomplishments through anecdotes, tears and laughter - very loud laughter. If you are need of some heartwarming entertainment, then don't hesitate to download this uplifting, true story. This is a great resource for families with a child with hearing loss, or anyone who enjoys uplifting human interest pieces. Transcripts of all episodes are available at [Luriechildrens.org/Amplified](https://luriechildrens.org/Amplified)

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