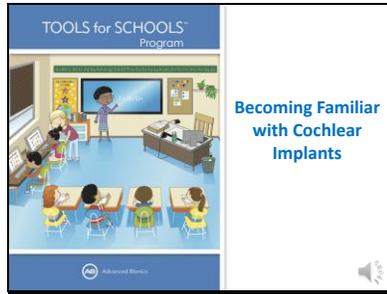
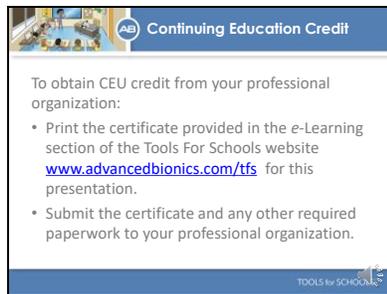


Slide 1



Hello and thanks for joining us to learn more about cochlear implants. Today's presentation provides a basic overview about cochlear implants candidacy, how cochlear implants work, and how to help children with cochlear implants succeed. It is part of a two part presentation titled Becoming Familiar with Cochlear Implants.

Slide 2



If you would like to submit for continuing education credits to your professional organization please print out the certificate of completion provided at the Tools for Schools website under eLearning for this presentation. Submit the certificate with any other required information to your professional organization.

Slide 3



If you would like to print out slides and take notes, or print out a script so you can follow along with the audio, please visit the companion materials section for this presentation in the e-learning section of the TFS webpage.

Slide 4



Advanced Bionics is dedicated to helping people with hearing loss hear their best. AB has partnered with Phonak. This partnership has allowed AB to offer unique technological advances to help people with hearing loss hear better in even the most challenging listening situations. From offering technologies that grow with children as they learn to listen and make sense of the world of sound... To helping adults get back to connecting and communicating with the important people in their lives, AB is dedicated to providing the unique hearing technologies that can help recipients achieve their hearing goals.

Slide 5



Here are the topics we are going to discuss today.

Slide 6

Who is a Candidate for a Cochlear Implant?

Children (12 months and older)

- Profound, bilateral sensorineural deafness (≥ 90 dB HL)
- Little or no benefit from hearing aids

Adults (18 years+)

- Severe-to-profound, bilateral sensorineural hearing loss
- Less than 50% speech recognition with hearing aids on open-set sentence recognition

TOOLS for SCHOOLS

Cochlear implants are approved by the FDA for both adults and children. Candidates are typically evaluated by a team and candidacy is determined on a case by case basis. The current candidacy guidelines for cochlear implantation are listed here.

Slide 7

Who is a Candidate for a Cochlear Implant?

FDA-Approved Criteria for Pediatrics:

- 12 months – 17 years of age
- Profound bilateral SNHL
- Trial with appropriately-fit hearing aids
- Little or no benefit from appropriately-fit hearing aids

Hearing Level (dB HL)

Frequency (Hz)

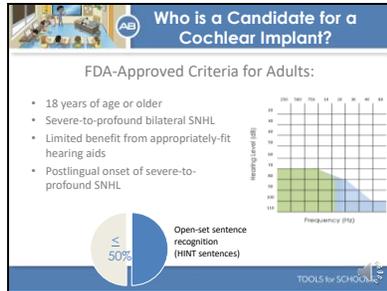
≤ 12% Difficult open-set word recognition test

≤ 30% Open-set sentence test

TOOLS for SCHOOLS

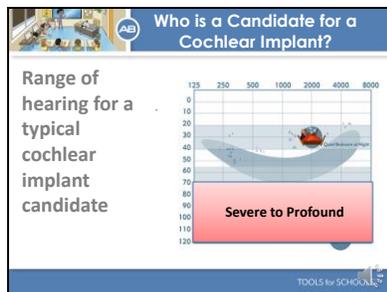
Let's look more closely at the pediatric guidelines. Children should be between 12 months – 17 years of age and exhibit profound sensorineural hearing loss in both ears. They must have a trial with appropriately fit hearing aids and show little to no benefit from these hearing aids. Little to no benefit is defined for children older than four years of age as scores of less than or equal to 12% correct when repeating back words through hearing only or less than or equal to 30% correct when repeating back sentences. If the child is less than 4 years of age, little to no benefit would be defined as failure to reach developmentally appropriate milestones.

Slide 8



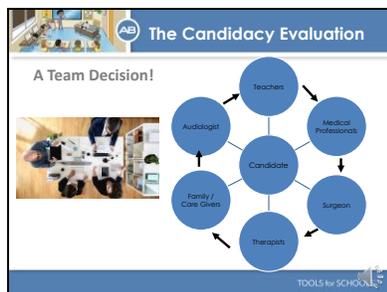
Adult candidates should have a severe to profound sensorineural hearing loss in both ears and show limited benefit from appropriately fitted hearing aids. This is defined as scoring 50% or less when asked to repeat back sentences through hearing alone. The hearing loss should be post-lingual which means the profound hearing loss occurred after age 6.

Slide 9



This slide shows the audiometric profile of a typical CI candidate. The guidelines we have just reviewed are just that, guidelines. Cochlear implant teams can decide to move forward with cochlear implantation even if the candidate profile is outside of the specified criteria.

Slide 10



A team of professionals work together to evaluate and determine the right course of action for a child and their family.

Slide 11

The Candidacy Evaluation

Typical Components for Pediatric Evaluation

- Audiologic Evaluation
- Medical Evaluation
- Speech Language Evaluation
- Developmental Evaluation
- Educational Evaluation



TOOLS for SCHOOLS

Speakers Notes: To determine candidacy a child participates in a series of evaluations. You can see them listed here.

Slide 12

The Candidacy Evaluation

Audiological Evaluation

Determine the type and degree of hearing loss

- Audiogram
- ABR & OAEs
- Tympanometry

Assess the child's current amplification system

- Aided sound field testing
- Aided ear specific testing recommended
- Aided speech perception testing



Counseling

- Address realistic expectations
- Device selection
- Post-operative follow-up

TOOLS for SCHOOLS

Now let's take a closer look at the evaluation done by the audiologist. Several tests will be completed in order to understand the type and degree of hearing loss. For babies and young children the audiologist will typically use a combination of audiometry and objective measures such as an auditory brainstem response test. These tests were discussed in module 1 of this presentation. The audiologist will also fit the child with hearing aids or evaluate the child's current amplification. The goal of the audiologist it to confirm the child is fit with hearing aids that provide appropriate access to sound. Additionally, s significant portion of the evaluation involves talking to the families. Many families are experiencing hearing loss in a child for the first time. Audiologists spend time counseling parents about how cochlear implants work and what is involved to make children successful. Parents are also given information, resources, and mentors to connect with and share experiences.

Slide 13



The Candidacy Evaluation

Medical Evaluation

- Determine the cause of hearing loss
- Assess status of middle ear & cochlea
- CT scan/MRI
- Counseling
 - Hearing loss
 - The surgical procedure
 - Typically out-patient and performed by an otolaryngologist (ENT) or otologist (ear specialist)
 - Post-surgical considerations



TOOLS for SCHOOLS

During the candidacy process the parents and child will also meet with the surgeon. The surgeon will try to determine the cause of hearing loss and have scans done to determine the integrity of the middle and inner ear system. The surgeon will also counsel families about the surgical procedure. The procedure is typically done as an outpatient, is minimally invasive, and performed thousands of times per year across the world. Most children resume their regular activities within a couple of days.

Slide 14

The Candidacy Evaluation

Bilateral Cochlear Implants

Bilateral Implants (one for each ear)

- Benefits:
 - ✓ Improved hearing in noise
 - ✓ Locating sound source
 - ✓ Incidental learning
- Simultaneous vs. Sequential

TOOLS for SCHOOLS

Bilateral cochlear implants, one for each ear, is becoming more common for both children and adults. This is due in part to the remarkable success and advancements to date with implant technology. We now know that children implanted early have the potential to progress quicker and to a more sophisticated level with their hearing than those implanted later. In addition, there are indications that children receiving two cochlear implants may be able to develop listening skills which aid them in understanding speech in noise, locating a sound source, and incidentally learning from their environment. A bilateral cochlear implant can be done as a simultaneous procedure (both implants placed in the same surgery time) or as a sequential procedure (an implant placed in each ear over two separate surgeries). For children, even with a delay of several years between placement of the two implants, benefits can be significant.

Slide 15

The Candidacy Evaluation

Speech & Language Evaluation

Assessment areas

- Hearing
- Understanding
- Speech
- Language

Counseling
Serves as a baseline evaluation



TOOLS for SCHOOLS

During the process the child will also be evaluated by a speech language pathologist (SLP). Typically, the SLP specializes in working with children with hearing loss. Each child is evaluated for their abilities based on his or her age. For example, a baby may be evaluated for his or her ability to hear and repeat sounds while an older child may be assessed to see how well they understand during a conversation. Overall the SLP will evaluate many areas such as how the well the child can hear, understand, and speak, as well as access the child's overall language skills. The child will usually be seen by the SLP several times during the candidacy process. This allows the SLP to determine if the child is making adequate progress with hearing aids or if the child should be considered for a cochlear implant. The SLP will also counsel families on consistent use of amplification and expectations pre-CI and post CI

Slide 16

The Candidacy Evaluation

Developmental Evaluation

Assessment of non-verbal & verbal IQ
– Verbal IQ assessed when appropriate

Assessment of child's learning style

Assessment of any other underlying issues

Counseling for family
– Impact of hearing loss on the family unit

Serves as a baseline evaluation



TOOLS for SCHOOLS

Some candidates will also undergo a developmental evaluation. Children with hearing loss are at high risk for coexisting developmental and/or medical issues. The developmental evaluation gives the team information on how the child learns best, areas of development which need to be addressed for the child to be successful, educational recommendations, and provides support to the family.

Slide 17

The Candidacy Evaluation

Educational Evaluation

Areas to consider:

- Communication methodology
- Speech/language and auditory skill development
- Support services
- Professional training

TOOLS for SCHOOLS

As you are aware, each child has a unique set of skills and challenges. The cochlear implant is a method to provide deaf children with access to sound and the rehabilitation & education which follow are the means to which the child closes gaps in development. The educator can help determine how to best meet the child's needs for success in school by evaluating the child's strengths and assisting with recommendations for classroom placement. Areas to consider include the communication methodology and auditory skill development. The education professional can also coordinate and request additional support services that may be needed. Typically, one educator who works with a child with a cochlear implant will be key in facilitating training for other professionals who are new to cochlear implants and need support.

Slide 18

Procedure for Getting a Cochlear Implant

Two Stages

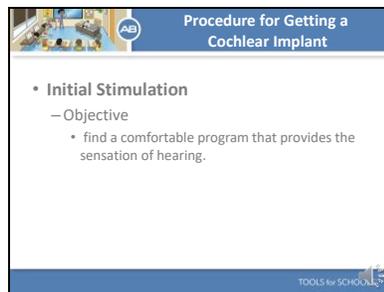
- Surgical placement of the internal components
- Fitting of the External Components
 - Initial Stimulation

TOOLS for SCHOOLS

There are two stages to getting a cochlear implant. First the child will have the internal device placed during the surgical procedure. The surgical placement of the internal device into the inner ear is performed under general anesthesia and takes approximately two hours. Typically, the surgery is done on an outpatient basis in which the child arrives in the morning and goes home that same day. Occasionally, an overnight stay may be necessary. A few weeks later, once the surgical site has healed, the child will be fit with the external components.

The day the child is first fit with the external components is called the initial stimulation.

Slide 19



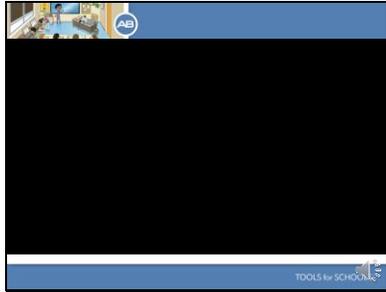
Procedure for Getting a Cochlear Implant

- **Initial Stimulation**
 - Objective
 - find a comfortable program that provides the sensation of hearing.

TOOLS for SCHOOLS

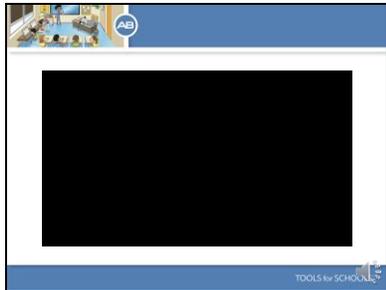
The objective for the Initial Stimulation is to find a comfortable program or map that provides the sensation of hearing. During this visit the child's audiologist will connect the child's sound processor to a computer and create a customized set of programs. It's during this process that the child should begin to be able to hear sound. Children can have a variety of reactions to sound on the day of initial stimulation. They may be alarmed by what they hear, they may ignore it, or they may have a very positive reaction. Any of these responses are considered normal.

Slide 20

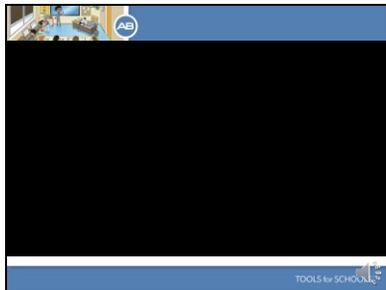


Let's watch a few videos that show us how patients may react during the initial stimulation.

Slide 21



Slide 22



This video of Joey was taken right after initial activation when comfort was achieved and the audiologist was testing his speech identification.

Slide 23

What You Will Learn Today

- Cochlear Implant Candidacy
- **Cochlear Implant Basics**
- Today's Cochlear Implant System
- Management of a child with a cochlear implant

TOOLS for SCHOOLS

Now that we have learned how candidacy is determined let's move on and discuss what a cochlear implant is and how it works.

Slide 24

Cochlear Implant Basics

A cochlear implant system consists of two main parts:



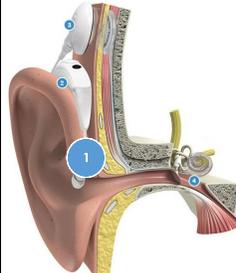
The diagram shows two options for an external sound processor. On the left is a white, oval-shaped device labeled 'Internal Implant'. To its right is a blue plus sign. Further right is a white, ear-shaped device labeled 'External Sound Processor'. To the right of this is the word 'or' and a red, rectangular device with a circular microphone, also labeled 'External Sound Processor'.

Internal Implant External Sound Processor

TOOLS for SCHOOLS

Unlike a hearing aid, the cochlear implant system requires two components to function— an internal **implant** and an external sound processor.

Slide 25



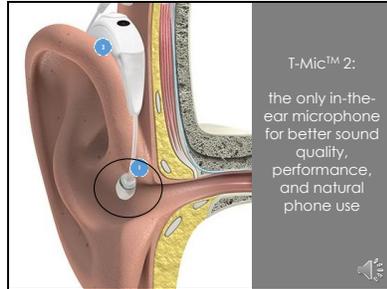
The diagram shows a cross-section of the human ear. A blue circle with the number '1' is placed over the external ear, indicating the location of the microphone. Other parts of the ear are labeled with numbers 2, 3, 4, and 5.

Sound is captured from the environment with one or more microphones

TOOLS for SCHOOLS

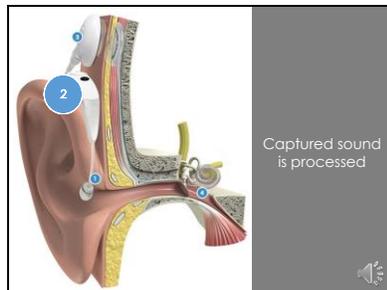
Let's take it step by step and learn how a cochlear implant works. Sound is captured from the environment, with one or more microphones.

Slide 26



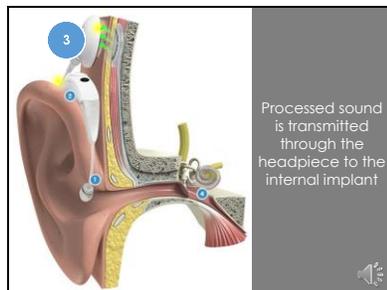
I want to take a moment to highlight our T-Mic. There is no other microphone like it. It captures sound at the natural location and provides improved hearing.

Slide 27



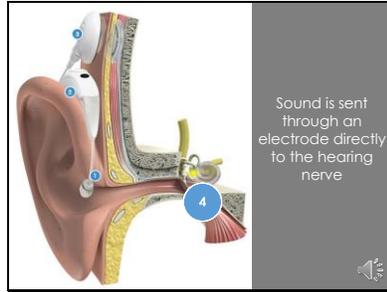
Once sound information is captured it is sent from the microphone to the sound processor where it is processed into digital information.

Slide 28



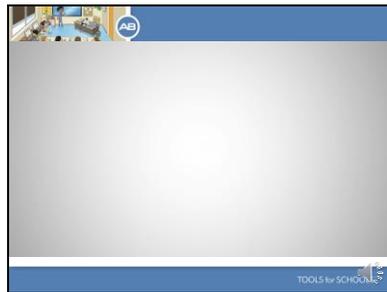
The sound information is then transmitted through the headpiece to the internal implant.

Slide 29



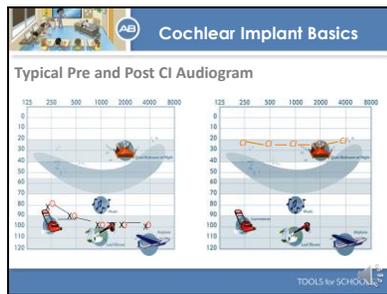
The internal implant then converts the transmitted information into electrical signals which are delivered to the electrodes. The electrodes then stimulate the hearing nerve. Finally, the hearing nerve transmits the signal to the brain where it is perceived as sound. Let's watch a short video that also explains how a cochlear implant functions.

Slide 30



Let's watch a short video that also explains how a cochlear implant functions.

Slide 31



This is a typical audiogram for a child before cochlear implantation and this is a typical audiogram after they have received and practiced using his/her cochlear implant. As you can see the cochlear implant has given this child access to a wide range of sounds including speech.

Slide 32



Slide 32: What You Will Learn Today

- Cochlear Implant Candidacy
- Cochlear Implant Basics
- **Today's Cochlear Implant System**
- Management of a child with a cochlear implant

TOOLS for SCHOOLS

Now Let's learn a bit about today's cochlear implant system

Slide 33



Slide 33: Today's Cochlear Implant System

Internal Device
HiRes™ Ultra Implant is designed for performance
Upgrades without surgery

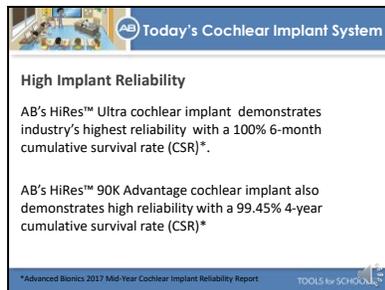
- Thin
- Impact resistant
- MRI compatible
- HiFocus™ 2.0 mm² Electrodes

UNMATCHED TECHNOLOGY

TOOLS for SCHOOLS

As we discussed earlier the cochlear implant consists of both an internal device and external sound processor. Here you see AB's most recent internal device called the HiRes™ Ultra implant

Slide 34



Slide 34: Today's Cochlear Implant System

High Implant Reliability

AB's HiRes™ Ultra cochlear implant demonstrates industry's highest reliability with a 100% 6-month cumulative survival rate (CSR)*.

AB's HiRes™ 90K Advantage cochlear implant also demonstrates high reliability with a 99.45% 4-year cumulative survival rate (CSR)*

*Advanced Bionics 2017 Mid-Year Cochlear Implant Reliability Report

TOOLS for SCHOOLS

As you can see the Advanced Bionics system has an extremely high reliability rate. 100% reliability at 6 months for our latest internal device and 99.45% reliability at 4 years for the 90K Advantage internal device.

Slide 35



Here you see the Naida CI Q90. This is AB's smallest and lightest behind-the-ear processor. AB & Phonak technology combine to provide proven superior hearing in noise, on the phone, and in water

Slide 36



Let's review the components of the Naida CI.

- Here is the Naida Processor.
- At the bottom of the processor is the power source.
- Here you can see the Universal Headpiece (UHP) and the headpiece cable.
- The round button located near where the UHP attaches to the processor is the Program Button.
- The Volume Control is located directly above.
- You can see here that the Naida's LED is located in the center of the volume control.
- There are also several microphones on the Naida processor. The front and rear microphone as well as the T-Mic and headpiece mic.

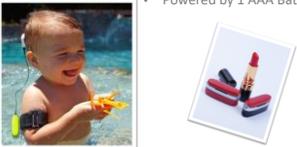
To learn more about how to use the processor please view our webinar on the Naida Processor.

Slide 37

Today's Cochlear Implant System

External Device
Neptune™

- Small body worn processor
- Waterproof
- Powered by 1 AAA Battery



TOOLS for SCHOOLS

Neptune™ is another processor option that is worn on the body. It is the only swimmable, showerable, bathable, play in the sandbox without worry, sound processor that is available from any cochlear Implant company. Neptune has many child friendly features including diagnostic indicators in the form of LEDs, Audible Alarms, easy to use detachable controls and more.

Slide 38

Neptune™ Sound Processor



Neptune Processor

Neptune Connect (user controls)

Cable

Battery Compartment

Universal Headpiece

TOOLS for SCHOOLS

Neptune has three basic parts: the sound processor, the battery cover, and the removable Neptune Connect control module. If you would like to learn more you can find a power point presentation on the Neptune in the companion materials link provided on the tools for school's website for this presentation.

Slide 39



Slide 39: What You Will Learn Today

- Cochlear Implant Candidacy
- Cochlear Implant Basics
- Today's Cochlear Implant System
- **Maximizing success with a cochlear implant**

TOOLS for SCHOOLS

Now that we have learned about cochlear implant technology lets discuss how we can help children be successful. Receiving a cochlear implant is only the first step in a long journey.

Slide 40



Slide 40: Maximizing Success

Factors that influence performance with a cochlear implant

- Length of deafness
- Previous experience with sound
- Age at implantation
- Commitment to listening therapy
- Full time use

TOOLS for SCHOOLS

The speed of progress and overall success of a child with a cochlear implant varies from one child to the next. This is because children come to the process at different ages, with different hearing experiences, and different levels of language development. There are many well-known factors that contribute to a child's hearing potential after implantation. Length of deafness, previous experience with sound, age at implantation, and commitment to listening therapy are some of the main factors that help to determine success. The keys to maximizing a child's hearing potential are daily full time use of the cochlear implant combined with listening therapy.

