

ROUGHLY EDITED COPY

**How to Reach Cochlear Implantation by 12-18 Months of Age  
And Why You Would Want To**

June 19, 2007

2:00 PM-3:00 PM EST

**Moderator: Donna Sorkin, Cochlear Americas**

**Presenters: Jean Thomas and Dianne Hammes**

*Captioning Provided By:*

*20/20 Captioning*

*[www.2020captioning.com](http://www.2020captioning.com)*

*Toll Free: 866-554-2099*

---

This text is being provided in a rough draft format. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings.

\*\*\*

>> Donna: Good afternoon, everyone. This is Donna Sorkin from Cochlear Americas. I see we have a couple of people signed on and I wanted to make a couple of announcements. First of all, we will have captioning for this event. It is one of our first captioned on-line events. If you need the captioning -- you probably

can't hear me but hopefully you have read the instructions and can write down that site and go and get it.

We will be making available both the PowerPoint presentation for today as well as transcripts for some of the videos that will be shown -- actually transcripts for all of the videos that will be shown as part of Dianne's presentation. And to download those, which I really do recommend that you do, go up to the links section at the top of your page. The instructions are at the bottom there, then download those. You still have time to print them out and have them in front of you. That handout includes both the PowerPoint and the video transcripts, so I recommend that you do that.

As always, we will be offering CEUs for this from both American Academy of Audiology and ASHA and that will -- that information will come to you automatically if you have been signed on for the entire event. You'll get an e-mail about it later with what you need to do to make that to receive those.

We will also be pushing out a feedback form to all of you at the end. And if you can return those to us, we're very happy to provide you with a certificate of participation which people tell me they are able to turn in at the State level for CEUs; plus, we just love to have your input. So I very much appreciate you providing that -- that feedback form at the end.

So we still have about 10 minutes until the start. We'll be starting right at the top of the hour so you have time to go get a class of iced tea or water or whatever and be ready to begin promptly. We'll start at the top of the hour. This is Donna Sorkin

from Cochlear Americas. Thank you for joining out us.

I want to make an announcement about the handouts for today. I have got a note from someone that they were unable to receive them. You should be able to access the handouts by going up to the links section and then downloading them to your computer or making a copy. We still have a few minutes before start time. If for some reason you are unable to do that, please just send me a note. I'm Donna Sorkin. I'm highlighted up there. You can e-mail me later and I would be happy to send them to you. My e-mail is [www.dsorkin@cochlear.com](mailto:www.dsorkin@cochlear.com). So I just want to remind everyone of our logistics for today. You do need to be logged on for the entire event to receive CEUs. And we will be offering CEUs from both ASHA and the American Academy of Audiology. At the conclusion of the event you will also be receiving a feedback form, and if you return that to the address on the form, we would be happy to send you a certificate of participation. And people tell me they have been successful in getting CEUs at the State level by returning those and we, of course, just love to have your feedback anyway.

This event will be captioned, and if you'd just write down the text there, you can get connected to the event. And it will be showing up right on the bottom of the screen. So we're very pleased to be able to offer that today.

We'll be starting in just about five minutes, which is at the top of the hour, so you still have time to go get a cup of coffee or some iced tea. This is Donna Sorkin from Cochlear Americas. We look forward to seeing you in a few minutes.

>> Donna: This is Donna Sorkin from Cochlear

Americas. We will be starting in two minutes. I want to remind everyone that we will be offering captioning at this event. Any instructions are right there on the screen. We will be getting CEUs from both ASHA and the American Academy of Audiology. You'll receive an e-mail for that at the conclusion of the event or possibly tomorrow. And to view the handouts, you want to go up to the links section and then download the handouts which include both the PowerPoint and the transcripts of the videos which will be shown in Dianne's portion of the event, and either save those to your computer or make a copy for yourself. You also can send one of us a note by clicking, right click -- by clicking on our name, and you can send us a little note if you wish. Our two presenters today are Dianne Hammes and Jean Thomas, and I am Donna Sorkin from Cochlear Americas. You can certainly send either of us a note hopefully while we're not talking. If you have questions, please save those for the end of the talk. We will -- we'll be reserving some time at the end for people to send in their questions to us. And I think with that we're about ready to begin.

If we could go to the first slide. As you can see our talk is called, How to Reach Cochlear implantation by 12-18 Months of Age and Why You Would Want To. And we're very, very pleased to have with us today, Jean Thomas, who is an audiologist and Dianne Hammes, who is a speech pathologist, and if we could go on to the next slide.

We offer these on-line events about twice a month throughout the year, and we do this because we know that as an independent company we make a very fine product, but it is really

what you do as professionals that make the difference in terms of how a child is going to perform with their cochlear implant. And, so, we're very pleased to support you in any way that we can, this being one of those ways through the on-line program.

Our speakers today -- and I want to introduce our first speaker, Jean Thomas, on the next slide, is a pediatric audiologist with the ECHO Program at the Carle Foundation Hospital. Carle's ECHO program stands for Expanding Children's Hearing Opportunities. Jean works with children who uses hearing aids and cochlear implants, and she has very extensive experience with the potential testing which she will be talking about today as well as other methods of identifying childhood hearing loss.

Our second speaker, Dianne Hammes, is right there. You can have a visual portrait of Dianne as you listen to her speak today. Dianne is a speech pathologist with ECHO as well. And she is a therapist and also conducts research on language outcomes and children with cochlear implants, including an extensive amount of research on the impact of the age of implantation on a child's outcome, and that is what she's going to be sharing with you today. She also has experience in working with children with a variety of communication modes including auditory, verbal, queued speech and total communications. So she has wide experience.

With that, I'm very pleased to turn the floor back to Jean Thomas, who is going to lead off with us today, and Dianne will wrap up at the end.

>> Jean: Okay. Again, my name is Jean, and I'm a pediatric audiologist with the ECHO Program. Our team has had

many years of experience in working with children with hearing loss in families and we want to share some of those experiences we've had with you today.

In this hour we're going to be covering the following objectives. We're going to be looking at the importance of early intervention for speech and language development. We'll be looking at technology's role in providing and maximizing audibility of the speech signal for the child with the hearing loss when you have an infant with a severe/profound loss. We'll also be talking about when to refer for cochlear implant evaluation. And, finally, Dianne will look at the speech and language outcome with the children we follow at ECHO at various age groupings, and specifically she'll look at the outcomes of children implanted under 18 months of age.

I believe the majority of today's audience is familiar with early intervention and involved in giving that intervention and, so, let's just quickly review then the rationale.

We know there are critical early periods for language development. We know that speech and spoken language development requires auditory input. So when there is a delay in getting that auditory input to the child with hearing loss and a delay in intervention, we're going to see a result in gap in language skills.

The importance of early intervention has been recognized nationally. The States have developed their early hearing detection and intervention programs or the EHDI. The Centers for Disease Control and Prevention have developed a series of national goals that support the urgency of intervention stressing that this must occur early in the infant's life to make the greatest

impact in language development. They have developed the 1-3-6 rule. It states that newborn hearing screening should be completed by one month of age, diagnostics completed by three months of age, and follow-up and intervention in place by six months of age.

How then do we implement the 1-3-6 rule put forth by the CDC? We're going to look at the diagnosis and intervention of infants who have hearing loss. Today's technology allows for early and accurate assessment. It then allows us to early and accurately fit the hearing aids and verify the fitting. And when all of this can happen by that six month goal, we can affectively maximize audibility of the speech signal to aid in spoken language development.

Let's discuss the speech signal and how its loudness and frequency characteristics are displayed on the audiogram, but first a review of this graph where we record the child's hearing loss.

Across are the frequencies that make up the signal. 250-hertz from the low end and 800-hertz to the high frequency end, and along the side is the loudness scales and decibels, zero being the softest and 120 being the loudest.

Displayed now in the upper half of this graph is the speech range, otherwise called the speech banana because of its shape. This shape represents how speech at an average conversational loudness follows across the speech frequency range.

This diagram contains a representative group of consonants and vowels found across that speech range. For example, in the high pitch consonants, f, s, t, h are in the high frequency end of the graph above 4000-hertz. Note the speech

banana goes up at this point indicating the softer intensity we use to produce those sounds.

So what does this mean for a child that has a hearing loss? Here we have overlaid a mild to profound hearing loss across that speech range. The portion of the speech range that is below the hearing threshold is audible to that child. Note though that the high frequency end of that speech range is above the thresholds and, therefore, it is going to be inaudible for the child who is attempting to learn language now with this incomplete speech signal. The goal of intervention with hearing aids will be to restore the audibility of that portion of the speech signal that is now inaudible for that child.

Advances in technology have allowed us to accurately assess hearing at any age. In testing children, we use a cross-check principle, meaning that we don't rely on the results of any one assessment but look for agreement across the test battery.

I will discuss objective measures, some this afternoon, but take note that we do do additional assessments such as behavioral testing, diagnostic therapy findings, and look at the primary caregiver's observations.

The first objective measure that I would like to talk about is the ABR or Auditory Brainstem Response. This acts as a gold standard for threshold prediction. The reason it is used so well it can be obtained in a sleeping infant.

To review the ABR is an objective measure. It is the activity recorded from the firing of many auditory nerve fibers. This ABR response then allows for threshold prediction, but the ABR is

limited by its signal characteristics and its intensity. For instance, the click stimulus is centered in the high frequency area from 1-4000-hertz, and it has a limited maximum intensity of 90 dB while the low frequency tone bursts have a maximum intensity of about 70.

The second objective measure that is relatively new in the field is the ASSR, Auditory Steady State Response. This is an evoked potential like the ABR but with some distinct differences. As with the ABR, you can do it when the child is sleeping. In contrast, to the ABR, the signal used to elicit the ASSR response is frequency specific with a much higher maximum intensity than can be achieved with ABR testing. The outcome of the ASSR technique is the more precise prediction of the audiogram, and especially for those children with hearing loss greater than 70-80 dB.

For instance, if you have a child who has no response to an ABR to click stimuli, it best describes a range of possible hearing losses, but the best to worst case scenario is shown here. Without specific threshold information, we would have to fit the best-case scenario to prevent overamplification. This, of course, would result in a poor hearing aid fitting, inadequate amplification with the child with the profound loss. So the ASSR allows us to more accurately assess a severe to profound loss and then accurately fit the hearing aid.

How then do we use technology to assure the accuracy for hearing aid fittings? We need to be able to ensure that the hearing aid is amplifying speech to be comfortable and audible to maximize speech understanding. And there are three main

verification methods that can be used with the infant and young child. These are functional gain testing or the behavioral audiogram objective methods such as the ruler measurement and diagnostic therapy.

In an aided audiogram, we recorded the child's aided behavioral response to auditory stimulus in the sound field, and that means signals coming from speakers. For instance, in this case, a moderate loss is plotted on the graph. Note that the majority of the speech range is inaudible to that child at an average conversational level. The goal of the hearing aid is to make the amplified speech signal audible and comfortable. The functional gain provided by the hearing aid is recorded here by the red "A" and it verifies the child's responsiveness for soft sounds. We can see that this hearing aid is successful in making soft speech audible across the speech frequencies; however, it does not verify the hearing aid output and its response to loud speech.

Behavioral verification of hearing aid benefit is also of limited use with infants. Behavioral responses are not reliable until about 6-8 months of age; therefore, functional gain should be used in conjunction with other verification methods.

An objective verification method involves the use of a computerized real ear measurement with a probe microphone system. In this verification method a fitting formula such as the DSL or NAL is used to calculate computerized targets for gain and output of the hearing aid. To aid in the process the RECD, or Real Ear to Coupler Difference, is measured, and this provides us with an individual measurement of the size of the child's ear. The RECD is

incorporated into the target and the fit is verified with a probe microphone system. This is a screen shot from the verified microphone system. I'm using this to illustrate the verification of a hearing aid fitting and first note the screen is settle up like an audiogram with the frequencies across the bottom and the dB or loudness scale on the side. The x's represent a moderate hearing loss. The shaded area is the amplified speech range or that speech banana that we talked about. Remember, prior to the hearing aid, the range would be above the hearing loss level and inaudible for this child.

Now we run a speech signal through the hearing aid and the amplified speech signal is represented by the shaded area. The pluses -- let me see if I can grab a pointer here. The pluses here are the target for our gain and the asterisks are the target for the output and the x's here are the hearing loss levels.

This hearing aid is an appropriate fit. As verification shows its speech is audible and within a comfortable range. This is an example of a hearing aid that is not appropriately fit. You'll see that the highlighted, high frequency end of the speech range is not audible as it falls above the hearing thresholds. The hearing aid settings will need to be adjusted in this case to provide additional gain and output in the high frequency region in order to provide odd ability for the high frequency speech sounds.

Hearing aid benefit can also be verified in the therapy situation. It is during therapy that the therapist and family can observe and record the infant's vocalizations and auditory skills and play instruction in an environment. The therapist can use the

prelexical vocalizations as a window into what the child may be hearing. From all assessments such as the IT maze (sp) can have skill development with the hearing aids.

I would now like to go through a quick case study that pulls together the information presented regarding early intervention and maximizing audibility. This is a case study on an infant that failed his newborn hearing screening and follow-up testing at 15 days of age. So we've already met the first part of the 1-3-6 rule. The child had screening completed by one month of age. Family history was remarkable for another brother with a hearing loss. Pregnancy was unremarkable. The child was referred to the hospital, the ECHO Program, for diagnostic evaluation at seven weeks of age. ABR testing showed no response to clicks and, so, we moved straight to the ASSR.

Also what was a concern for us was the child had had a severe/profound loss with no response at the limits of that test which is very high at 2- and 4000-hertz. So now we have met the second part of the 1-3-6 rule, the child has completed diagnostic evaluation prior to three months of age.

So we had a predicted audiogram following that ASSR testing by two months of age. Behavioral testing in an infant cannot begin until they can do a conditioned response and, so, we started behavioral testing at five months of age with this child, but due to poorly liability, the infant could not be ready for the test. We started with a vibratory stimulus, and by seven months of age this child was able to do a complete behavioral assessment. What we saw was in very good agreement with that predicted audiogram we

had at two months of age to the behavioral finding we got at seven months of age. The yellow is the ASSR and the red and the blue is the behavioral responses. And these are actually in very good agreement when you consider that behavioral thresholds are really minimum response levels, meaning that they're slightly above threshold. So we had pretty accurate data to work with at two months rather than waiting until seven months of age to get a better picture of what this child's hearing loss was like.

So we took that data at two months and fit the hearing aids by 2.5 months. We did use RECD measurements to do the fittings with DSL targets. This child attended diagnostic therapy beginning at three months of age, and it is through this process that the child or the family chose an oral method of communication. So here now we've met the last rule, the 1-3-6 rule. We have achieved intervention prior to six months of age.

This is one example of a functional gain audiogram and this child was fitted two months of age and this audiogram was done about eight months of age, so just looking to see how the hearing aids are providing benefit. And you can see with the hearing aids they fit early and fit appropriately, and they are not providing adequate benefit. That there is much of that speech range that is still inaudible for this child.

This aided benefit was also confirmed with probe microphone measures that indicated benefit, especially in that high frequency region. And the test of auditory function also showed poor auditory development. Diagnostic therapy findings were also in agreement and showed limited speech and spoken language

gains. And, so, this child did eventually receive a cochlear implant.

To review with you the FDA guidelines for cochlear implant candidacy, the child should be 12 months of age or older, have a profound loss in both ears, show little to no benefit of appropriately fit hearing aids, demonstrate a lack of auditory progress, have family motivation to improve hearing, appropriate expectations should be in place, and no medical contraindications.

There is a large body of reports in the literature that support cochlear implantation in infancy as being safe and effective. Many studies detail the positive outcomes seen in this population and Dianne Hammes in a moment will discuss our outcome data with this age grouping.

In conclusion, let's review the early interventions, the professional role, in providing early intervention and in maximizing outcomes for the child who has a hearing loss. The early intervention professional needs to keep the 1-3-6 rule in mind as they work to secure early intervention and oral rehabilitative services by six months of age or we would suggest even earlier. The CI professional will provide a non-biased parent education on the options the family needs to address in the early months. The professional not providing the hearing assessment and hearing at sitting will need to look for verification that this has been done, and that auditory access to the speech signal is maximized. If this has not happened the benefit that oral rehab services can offer will be limited as the child's speech and language development.

And finally in the case of the severe to profound loss, referral for cochlear implant evaluation with a parent should take

place by six months of age. This gives the cochlear implant team time to address issues such as secondary disabilities, health issues, parent education, motivation, and still reach the goal of early implantation if appropriate.

The need for this early referral for evaluation is illustrated in the infant demographics we have compiled. For those infants receiving cochlear implants through the Carle Foundation Hospital ECHO Program. These are the cohorts that Dianne Hammes will be presenting outcome data on in just a moment.

Note that the infants implanted by 12 months of age met and surpassed the 1-3-6 rule. The majority had newborn hearing screening completed before one month of age and completed diagnostics at two months of age and had an average hearing aid fitting by three months of age.

With early intervention secured by three months, the family and the cochlear implant team professionals were able to discuss issues related to the cochlear implant with the families and provide appropriate education so they were ready to make the choice for an implant when the implant team concluded that limited aided benefit was obtained.

In contrast, those infants implanted between 13-18 months did not meet the CDC 1-3-6 rule and were implanted on average six months later.

In conclusion, we have found that at our hospital, in our ECHO Program, that if a coordinated effort between early intervention professionals and an experienced pediatric cochlear implant team can begin immediately after diagnosis, cochlear

implantation can occur at 12 months of age.

I'll now be turning over the microphone to Dianne Hammes, a speech language pathologist with our program, who will share the speech language outcome data with our group of children with implants. And, Dianne, I'll give it to you.

>> Dianne: Thank you, Jean. Welcome to everyone. Now that Jean has -- let me get my slide going. Sorry, we have lost the -- let me scroll through some of these here. There we go.

Now that Jean has described how we reach implantation during infancy, I'll talk about why it is so advantageous to do so. Specifically first I'll present data collected at Carle supporting early implantation. Data will be contrasted comparing speech perception, spoken language and speech production, performance of the children implanted at our center by 18 months of age to that of groups of children implanted at our center at slightly older ages. After that, I'll show video clips that will highlight a child from each age at implantation grouping so that you can observe firsthand some of the commonalities and differences and skills that we see in the various groups.

So data analyzed for 66 consecutively implanted children ranges in age from 7-48 months at the time of implantation and the groups were similar in terms of their degree of hearing loss and endemiology and they differed in our core subjects such as those with significant cognitive delays were not included in the analysis.

The children were assigned to one of the four following age groups based on the age at which they received their cochlear implant. So the first graph illustrates the main age and implant

usage among the four comparison groups. All of these children have at least six months of implant usage. As you can see, the mean current age ranges from 7.5 years of age for the 19 children implanted by 18 months of age up to just over 15 years of age for the 12 children who were implanted at 41 to 48 months. And their mean length of use range from six years for the children implanted by 18 months of age up to more than 11 years for those implanted at 41-48 months of age.

First given that having good perception abilities auditorially is an important precursor for developing spoken language, we assess the children's ability to understand words with minimal need for context. This graph shows the children's average percentage correct scores for the phonetically balanced kindergarten word list. This test is administered in an audio booth the child must first listen to and then repeat a word without being given any lip reading or facial queues. And for this graph scores are shown for the children in each group who have had at least three years of cochlear implant experience where at least three years of age at the time of testing and who simply had the perceptual abilities to take the test.

Those numbers that you see at the bottom of the graph show the number of children in each grouping who met both of the three-year age and experienced criteria and the denominator relative to the number of children who could take the test in the numerator.

And what is apparent on this graph is that the infant group does well averaging 75% correct than with similar or slightly

longer links of implant experience the children implanted between 19 to 30 months of age have also done fairly well averaging near 65% correct. In contrast, the children implanted after 30 months of age average closer to 50% correct. Now, to provide additional perspective with regard to these outcomes, the children shown here had an average of slightly more than five years of cochlear implant experience in that youngest age at implantation grouping in comparison to nine years for those implanted in the oldest age grouping.

For effective communication, one must be able to move beyond understanding of individual sounds and words to comprehension and use of the connected phrases and sentences required for conversational interactions.

This graph illustrates performance at the most recent language evaluation for each child across the age groupings. The scatter plot shows language age versus other ages and it is color coded shown in the legend and the white dash line represents the typical performance when a child has normal hearing. Then as an additional means of comparison to the hearing norm, trend lines are shown for each age at implantation grouping.

Now, looking at the individual symbols for the youngest age group or the symbols in red, you notice that the majority of children are performing at or very near to that dashed line very similar to normal hearing children. Children in other groups may be mirroring or at times on that line but notice as a whole the trend lines for the groups fall increasingly away from the hearing norm indicating that the gap between language age and chronological age

is getting larger for each age at implantation grouping.

You'll also notice that although most of the children implanted by 18 months of age are at or near that dash line, there are still some outliers and what we found through previous analysis is that where several of the children have developed spoken language skills comparative to or even exceeding that of hearing peers, others do demonstrate gap in language relative to normal hearing peers but the extent of their gap is either remained stable or decreased over time.

Second it was noticed that those who are progressing behind both of their hearing and deaf ears are those that have mild global delays or learning difficulties and those who have had inconsistent device usage and/or poor compliance with recommended follow-up care.

Well, finding how well the children implanted by 18 months of age were doing provided that hearing loss was their sole disability and family involvement and intervention services were consistent.

This next graph shows data across the groups -- whoops, let's get this next graph up there. It shows data across groups for only the children meeting these criteria. Calculating a language quotient is a means of demonstrating the size of a child's language gap. It is derived by dividing the child's language age by his chronological age so as -- chronological age so as such a language quotient of one indicates that a child's language age and chronological age are equivalent which is typically the case for children with normal hearing. This graph shows the language quotient average for each

of the age at implantation groupings.

As can be seen, as a group, those implanted the youngest are nearing age level expectations. This is not the case for those implanted after 18 months of age. As important is having good language skills for communicating affectively and efficiently verbally is having intelligible speech.

This graph illustrates the error rates in percentage of occurrence for the Goldman-Fristoe2 for each age at implantation grouping. This is constant productions based on the placement of early childhood words such as window or wagon. The scores are shown for percentage of consonant errors by location in the words. So the final is the total error rate shown in the last column after the dashed black line. You'll notice that the oldest age at implantation in blue and the youngest group at implantation in red make the fewest errors and have similar error patterns and percentage of errors.

I want to point out though that the children implanted by 18 months of age on average are still less than six years of age, whereas the children in the oldest age at implantation grouping are nearly 11 years of age. Relative to typically developing children with normal hearing loss, whereas at 5.5 to six years occasional speech errors are not uncommon, and by 11 years of age speech errors are unusual.

And although I won't go into detail on this graph, I do want to point out a similar pattern with those in the youngest and oldest age at implantation groupings obtaining similar error rates, and error patterns were seen on the Khan-Lewis2, which is a sister

test of the Goldman-Fristoe2, which analyses the phonological processes that the children use.

So reflecting this information in standardized scores, this last graph shows the mean percentile ranks for the Goldman-Fristoe2 cross groups. And even though the children in the youngest age at implementation groups still made a handful of errors, relative to other children their age, they still do fairly well averaging above the 30th percentile. And this is especially the case considering that schools often use a standard deviation of minus 1 corresponding at a 16th percentile is the cutoff for determining need for services. Those implanted after 18 months of age have not been able to meet this standard.

And, so, now I'm going to shift gears and show you video clips of four children, and one child from each age at implantation grouping, and now all of these children have had profound hearing loss since birth. I'll highlight elements I want you to watch for in each clip pointing out the similarities and differences that we often see based on age at implantation. And boss a frequent goal is that the children will be ready for integration with normal hearing peers by the time they reach kindergarten, and the first set of clips show each child near five years of age and, so, you can see the children after equivalent links of implant experience. On the second set of clips all children are shown after five years of implant use. Please see the written transcripts I have provided for the clips should you want to follow along.

As you view this first set of clips, try to imagine the strengths or limitations each child might have in a kindergarten

setting. So child one was implanted at three years and nine months. He is one and a half years post in this clip. At five years four months his language age is two years, eight months. Although language delays are evident, there are many positives for him. You'll see that he can consistently vocalize with his signs and his vowels are generally accurate. His vocal quality is generally nasal, but he uses stress for emphasis. His communication is at times successful based on speech alone, and he will persist in making himself understood. He also follows routine directions auditorially at times, and you'll see that he often voices grammatical markers even though he doesn't necessarily sign them.

(Video Clip)

>> What is the girl doing?

>> What is the girl doing.

>> Good. Do this again. Tell me.

>> Riding.

>> Good.

>> Oh!

>> That's okay of the we'll do those later.

>> Where is doing -- Dad coat. Huh?

>> What are those? What are those?

>> Okay.

>> Oh, this way. Daddy wshsh. Milk cup.

>> Tell me again, I'm sorry.

>> Daddy, go help milk cup.

>> Okay. What is Dad doing with the milk? What's Dad doing?

>> What is doing?

>> What is he doing? What is the girl doing?

>> What girl doing, boy, go more cup.

>> Do this again.

>> Dianne: Sorry about that. We'll move on to the next

clip. Happy trigger finger, too fast there. This child was implanted at two years and seven months, and at five years nine months he is the oldest five-year old in this clip. He has had three years of implant experience at the time of the clip, and his language age is three years five months. As with the first child, language delays are present; although this is the case where verbal communication is established. You'll notice that his vowels are generally accurate but consonant errors do remain. He is slightly monotone at times. He generally uses natural stress and intonation patterns. The descriptive language is difficult for him in part related to gaps in language or vocabulary development that still exists. Despite this, he generally follows simple conversational exchanges well, even when looking down or away.

(Video Clip)

>> Okay, good.

>> High-five, good job. Use the peanut butter.

>> Using the bread.

>> And I use the bread.

>> And I use jello

>> Jello or jelly?

>> Jello

>> That is called jelly.

>> Jelly. So I use the jelly.

>> And just wipe out.

>> Just like this?

>> No! I'll show you.

>> Okay.

>> You gotta do like this.

>> Okay, spread it that way, okay. I don't have any bread down there.

>> Huh?

>> I don't have any bread on my paper towel. What do I need to do?

>> Um, you need to use the butter and put the bread right down here.

>> Okay, I put the bread there, okay.

>> Okay.

>> Okay. I put the bread there.

>> And you need this open.

>> Oh! I need to open it! Okay, how should I open it?

>> Right here.

>> Well, don't show me. You need to tell me with your words. How should I open it?

>> Ahh, right here.

>> Right here? Like that?

>> No!

>> No? How should I open it?

>> Right there.

>> What is that called? Do you know what that's called?

>> You gotta pull tight.

>> Pull it tight this way?

>> No. Open it.

>> Open it. So I have to pull it loose. I have to pull it loose. I'll pull. I'll pull on the wrapper. There -- okay, now what?

>> And then you put the key butter on here.

>> Okay. Puh the --

>> No.

>> You told me to put the peanut butter on there.

>> No. Take this out

>> Oh, okay! I'll take -- take the bread out.

>> Dianne: Child three was implanted at two years seven months, and although she is seven months younger than the previous child, her language skills are fairly similar to his with a language age of three years and three months. She, too, typically communicates verbally, but at times she or her family will incorporate signs as well. You'll notice that her vowels and many consonants are accurate but errors do still occur. She uses very natural stress and intonation patterns, and in many ways her articulation skills are similar to that of normal hearing children near three years of age or so, which is the length of time she's had her cochlear implant. And although she's able to follow conversation coming from many different directions, she does still often requires processing time or repetition. Also, watch her eye gaze as the different people speak. You'll notice that she frequently shifts her gaze as the various people begin speaking.

(Video Clip)

>> Are you going to cut it?

>> Yep, now I cut it

>> Cut it with what? What are you cutting it with?

>> Pizza.

>> What are you putting with?

>> Didders (sp).

>> Scissors.

>> I would -- I have a piece of pizza.

>> Hey, where does the cookie monster live?

>> Sit down.

>> Where does he live?

>> In the tent.

>> Huh?

>> In a tent?

>> I make pizza.

>> Oh, can I have a piece?

>> What about Dianne?

>> I would love to have a piece of pizza. How much does your pizza cost? How much does your pizza cost?

>> Do I have to pay you? Do I have to pay you some money?

>> Yes.

>> How much do I have to pay you?

>> 21.

>> \$21 or 21 cents?

>> Yeah.

>> 20. That is expensive pizza.

>> It better be the best pizza in the world. Here is your money.

>> Good pizza.

>> Do I get any change?

>> Yeah.

>> Thank you.

>> Thank you.

>> This is delicious pizza.

>> That's the money. That is pizza.

>> You ate the money.

>> Dianne: Child four was implanted at one year one month. She is five years two months in this clip and her language age is five years and six months. At the time of the clip she had had four years of implant experience and just started kindergarten with her normally hearing peers. You notice occasional articulation errors are present, but the errors she makes are what others her age might also make. She uses natural stress and intonation patterns and easily communicates even when not looking at the speaker. She is also able to follow more complicated language such as identification by description, and she uses many casual conversational markers such as mmm and hum and huh-uh. At the very end watch as she uses her auditory feedback loop to help her correct her speech.

(Video Clip)

>> I'm going to listen to how you say your words.

>> House.

>> That is a house. What is next to the house.

>> A tree.

>> A tree? That's a big tree. And what do you see on the house? They're made of glass.

>> Windows.

>> That's right. There are lots of Windows, aren't there?

>> Mmhmm.

>> What do you see here?

>> Numbers.

>> Numbers. Numbers.

>> On the telephone

>> On the telephone. Have you ever seen a purple phone before? That is kind of weird, isn't it?

>> Mmhmm.

>> What do you see here?

>> Mmm.

>> Three things. You see a --

>> Yellow cup.

>> Yellow cup.

>> That's grandma's favorite color.

>> Is it? What is your favorite color?

>> Green.

>> Green. I like green, too.

>> Like the green cat.

>> Yeah, yesterday I had a green sweater on. Although it was a little hot. Hmm, what else do you see?

>> A knife.

>> And?

>> A spoon.

>> Bad timing.

>> There you go. Thank you. It is hard to talk with those chewy things, huh?

>> Mmmhm.

>> Dianne: Now, to even the playing field, the last set of clips I will show you are of the same four children at their five-year post implantation evaluation. So now although their ages vary more, length of implant usage is similar. So starting again with child one, he is now eight years 10 months of age and has a language age of five years and eight months. Although his language delays persist, you see the strides he's made with articulation errors that are still present, but by and large he can make himself understood through speech alone. He will at times use signs or gestures to help clarify what he's saying. And although a nasal vocal quality does remain, he typically does use stress and intonation patterns appropriately. You'll also see some of the semantics and grammatical errors that are still present.

(Video Clip)

>> There is your -- those your sisters?

>> I have my baby but she would be like my sister.

>> Huh. How old is Joanna?

>> She is one years old.

>> She's one years old. Is she cute?

>> Yeah. Her birthday is on March 15

>> Mine is on March 16

>> The day after her

>> The day after, yeah.

>> But --

>> My niece, her birthday is on February 14th. On Valentine's Day.

>> Mine is before her

>> You are, two days before her. So what else you got your G.I. Joe for Christmas. What else did you get?

>> Man of steel.

>> A man of steel?

>> Yeah.

>> Is that him?

>> No. That is an Army

>> That is the Army guy.

>> But I have man of teal steel.

>> And what was your -- what was the best part about Christmas this year?

>> I got a scooter for Christmas.

>> You got what?

>> A scooter.

>> A scooter?

>> Dianne: Child two is now seven years seven months and has a language age of five years and three months. In this clip we're playing a game called Guess Who? Occasional articulation errors are still present, but by and large his speech is easily understood. Often impacting his clarity more than articulation errors are the wording errors that he still makes. Aside from his

occasional language difficulties, he generally does follow conversation quite well. And some of the goals of this game with this child are that he will use thinking and reasoning skills and recall auditory information. At one point in this clip you'll notice where he realizes he's made a mistake in asking for information that he already knew. You'll also see some of his playful sense of humor.

(Video Clip)

>> (Laughter)

>> Is your person wearing a hat?

>> Nope. There is a person wearing --

>> Does my person have brown eyes? Yes, my person has brown eyes. Does your person have dark hair?

>> Nope. Does your person have yellow hair?

>> Nope. Does your person have -- does your person have orange hair?

>> Nope. Oh, yeah, yeah. Yeah. Yeah. Yeah. Yeah. Yeah. Yeah. Okay. Does your person have a little nose?

>> Yes.

>> Wait.

>> No -- oh, well. You got to remember it if you ask me before my person had a big nose and I said no. So does your person -- is your Bern bald?

>> Nope.

>> Do you know what that means? What does that mean?

>> You don't no hair have on it.

>> That's right.

>> Yeah, wait.

>> Yeah, I do.

>> Is your person bald?

>> Yes.

>> Dianne: Child three is now seven years one month and has a language age of five years seven months. As with the previous two children, her language age is more similar to the length of time she's had her implant than to her chronological age. And in this clip she's providing story lines from Mercer Mayer's wordless picture book, *One Frog Too Many*. You notice that her vowels and most consonant sounds are typically accurate, but speech is still a little slushy at times. The child makes very natural use of stress and intonation patterns and, in general, she follows verbal conversation quite well. Although this is the case, this task was challenging for her because gaps in vocabulary are still present, her inclination was often to show rather than describe what she saw. When prompted to explain though she was often successful. And similar to child two, intelligibility was often reflected by wording errors than articulation errors per se.

(Video Clip)

>> And the frog hit the baby frog and the turtle was talk -- walking and the, um, turtle was, no-the turtle, err the turtle went mmm --

>> Tell me in words instead of going went mmm. Tell me in words.

>> Um, he's angry because he kicked -- um -- her or him?

>> Whatever you want. Do you want it to be a girl or a boy?

>> Girl.

>> Okay. So the big frog kicked the baby frog -- kicked her off -- off the turtle's back.

>> And the, um, the boy went no, no, no!

>> What do you think he'd say to them?

>> Um --

>> To the big frog?

>> Um, you're a bad boy!

>> Mmm.

>> Um here he is sitting there and he's doing like um he's angry and he's -- he like saying like -- you stay there forever! Ever! And this -- and he -- and her -- and she is happy and these two are mad.

>> Yep.

>> Dianne: Child four is now six years one month and her language age of six years eight months continues to exceed her chronological age. You'll see that she follows conversation quite easily and that she comprehends the nuances of the sounds of language and both comments on them as she corrects the speech pathologist and has fun with them as she puts on a British accent. With her language skills, she would and does blend in quite easily with the other children in her first grade class who have normal hearing. I have to say my apologies for the taping on this one. I decided to include it despite the recording glitch because it is so well exemplifies the goals that we're ultimately trying to obtain with the

children.

(Video Clip)

>> With the fingernails, isn't it?

>> Can --

>> I don't think --

>> Can you try?

>> I don't think mine will work either (eyether). No, mine don't work so well either (eyether).

>> Eyether is not a word.

>> Either is a word. Some people say either (eether).

Have you heard that word? Either (eether). Just like on your movie with Nanny McPhee, the one that was -- was it the Nanny or the Mommy who said, behive instead of behave?

>> That was Aggie

>> Oh, that was Aggie, the baby?

>> No, that was Aggie.

>> But is Aggie the baby?

>> Yes. She said -- after mother said behave she said, she said behive, behive.

>> Behive, that's right. So I say eyether instead of either. That is just a different way of pronouncing it.

>> It's like when Aggie says behive, behive.

>> What other funny things do they say in there? Are there other words she says that sound kind of funny?

>> What does Aggie tell Nanny McPhee her name is? She doesn't say my name is Aggie. What does she say?

>> Bup-poop-bum. No, she says bum! You can't be a

bum 'cause your grandmother's a bum. Um, you're poop and then she says, then she says, poop-bum and -- and then the person who's bum, just bum, um says, you can't be poop and bum.

>> Dianne: So remember the children are shown in these video segments follow the patterns of the data I presented in the first portion of my talk with the children implanted, the oldest demonstrating the largest gap, and the child implanted, the youngest demonstrating the least or in this case no gap. The clips show the critical impact that implantation can and does have with respect to a child's ability to develop spoken language. Sorry about that, I'm here.

So in summary, I will reinstate Jean's message from the first portion of the talk. When all pieces of the process are in place, implantation can occur as early as 12 months of age. This is a realistic goal if the 1-3-6 rule that Jean discussed can be achieved. This means the child is identified with hearing loss by one month of age allowing for completion of diagnostics by three months and implementation of intervention by six months.

Given this scenario, a child should then be referred for implant consideration as early as six months of age so that the remaining pieces of the decision-making process have been carefully worked through prior to or very near to the child's first birthday.

And, in conclusion, these data demonstrate the dramatic difference that can be achieved when implantation occurs within or very near to the first year of life when a child has the greatest opportunity to benefit from the naturally occurring critical periods of development. So even though implantation at slightly older ages

does make a positive difference, implantation by 12-18 months of age can result in earlier open-set word understanding, smaller gap in spoken language development, relative to normally hearing peers, smaller gap in speech production abilities, and improved ability to achieve and maintain age-appropriate spoken language skills, especially with implantation by 12 months of age.

Thank you very much for your attention and for bearing with me through my little glitches here, and I'm going to now turn it over to Donna for some announcements while you formulate your questions.

>> Donna: Thank you so much, Dianne and, Jean. You can go on to the next slide. As Dianne said, if you have questions for either her or Jean, you can go ahead and just click on their names. After these very short slides, we'll have an opportunity for them to answer your questions.

I just wanted to remind everyone about upcoming sessions. If you have enjoyed the seminar, you can download the captions, the transcript of the captions, and have that by them as they watch the program. And that is all available on the HOPE website. Upcoming events, we have three seminars that I'm showing here. I won't go through them because they will be in your handout, but we will have a full program for this summer in general aimed at individuals who work with children, young children. We can go on to the next section, the next slide, and contact information.

If you have any information or any request you can always e-mail it to me, and my e-mail is there in the middle. Our

HOPE information is in the HOPE area of the website, but we really want you to send your certificate of participation back to the feedback right there. And, of course, the cochlear website has a lot of information on it as well on our products and on various guides, et cetera.

So I think with that, we'll move into the question portion of the format. You can go on to the next slide. Hopefully you have sent questions to Dianne and to Jean at this point. And again, you just want to click on the right side, right click on their names, and there is the HOPE feedback form. Thank you for pushing that out. Just save that to your computer and send that back to us. We would be happy to send you a HOPE feedback form. I think with that I'm going to just turn the program back to Dianne and Jean and they can answer your questions at this point. Thanks so much for being with us and thank you so much to Jean and Dianne for a very great and compelling presentation about the importance of early implantation and sharing their children with us.

>> Dianne: Thank you, Donna. Does anybody have any questions? I have not received any in my mailbox. We're going to turn it over to Jean and we can check in with her.

>> Jean: No, I don't have any new questions in my box -- oh, I do, just a moment. Actually a full message did not come in. If you want to send another message I'll look for that. Dianne, I'm not seeing any other question -- here we go, just a moment. Um, a question is, why continue to use the ABR if the ASSR is -- I'm sorry, the full question didn't come in. But why continue to use the ABR? The ABR continues to give us important information about the

neurological status of the auditory pathways and, so, it does give us information that the ASSR would not. Specifically when we're looking for a diagnosis of auditory neuropathy, the significance of the ABR is significant in that case. And I'm going to look now to another question that has come in, and that was just a question about handouts so we'll deal with that -- I'll pass that along. Are there any other questions this afternoon? Dianne, do you have anything else?

>> Dianne: I do not. With that I'll turn it back over to Donna for final closing statements. Thank you, everybody, again for your attention.

>> Jean: Thank you.

>> Donna: Thank you so much, Dianne and Jean. And again, I just do want to ask our participants to let your colleagues know that we now have captioning available. If anyone had any problems with the captioning or if you really liked it and you want to share that, please e-mail that to me at [www.dsorkin@cochlear.com](mailto:www.dsorkin@cochlear.com). And with that, I just hope to see all of you on-line very soon. And thank you for joining us on what is a very, very hot summer afternoon here on the East Coast, so I'm glad to be inside doing this seminar with Dianne and Jean. Thank you very much to them and their colleagues at Carle Foundation Hospital for sharing with us today.

\* \* \*

This text is being provided in a rough draft format. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a

**totally verbatim record of the proceedings.**