

**Early intervention**



**Dr. Muaaz Tarabichi**

Early intervention, coupled with providing binaural hearing seem to be the most important variables in rehabilitating children who are born deaf. On the 22nd of December 2008 we performed simultaneous bilateral cochlear implant on a 6 month old child, our youngest patient since the start of our CI program. Many advances have made this surgery possible. On the Audiological front, our increased ability to have a frequency specific information on these young children, coupled with the advances in programming techniques have allowed the restoration of hearing in these young patient. On the operative side, improved anesthesia technique and minimally invasive surgery have reduced the operating time to a manageable level and improved safety of operating on these young and fragile children.

**Cochlear Implant Hybrids: Who Is a Candidate? You May Be Surprised**



**Lubaina Sharafally, M.A. , CCC-A Clinical Audiologist**

The National Institutes on Deafness and other Communication Disorders, Dr. Ralph Naunton, Director of Human Communications, May 7, 1998, reported that, "...the benefits of cochlear implants are not limited to speech recognition but extended into dramatically improved language learning and language skills". Since that report, implant criteria have expanded, allowing a greater segment of the hearing impaired population to take advantage of the technology.

The expanded criteria have led to research questions - Can an implant benefit other users previously not considered to be a candidate? A group that was felt to be underserved with conventional amplification were those patients with the following audiometric profile:

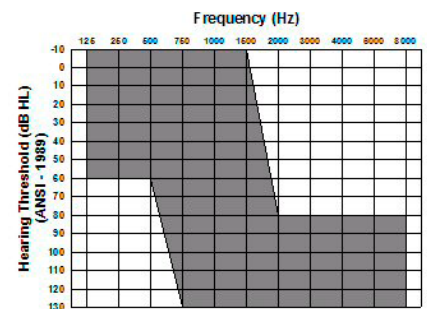
1. Severe to profound high-frequency sensorineural loss (see Figure 1)
2. Speech recognition scores in the best aided condition better than or equal to 10% but less than or equal to 60% on CNC words in the ear to be implanted
3. Speech recognition scores of less than or equal to 80% for CNC words in the contralateral ear

Typically, these patients perform adequately in quiet, relying on their residual low-frequency hearing. However, as the listening environment degrades, communication becomes more difficult due to the lack of high-frequency speech information. Amplification for this group of patients is mostly provided below 1000-1500 Hz, as the severity of the hearing loss above this frequency range renders conventional hearing aids ineffective. The damaged hair cells and/or nerve fibers in these so called high-frequency "cochlear dead regions", will not be sufficient to provide usable acoustic information secondary to the degree of hearing loss (Summers, 2004).

Cochlear implantation in these patients may be effective; but there is still a significant risk of damaging the residual low-frequency hearing from the insertion of the electrode array or from trauma related to the surgery.

"Soft surgical" techniques that focus on minimizing the forces imparted on the cochlea are now being investigated. The new array needed to be "minimally invasive" yet able to provide frequency specific stimulation to the high-frequency fibers necessary for improved speech understanding. The final step would be to combine the electrical stimulation presented within the cochlea and the acoustic stimulation presented through the normal sound conducting mechanism – cochlear implant / hearing aid hybrid technology.

Hybrid or Electric-Acoustic Stimulation (EAS) is the merger of these two technologies and is currently in clinical trials in the US. The feasibility of EAS was first reported by von Ilberg et al. (1999) and current studies have shown that acoustic hearing can be preserved in 75 to 90 percent of patients in whom a 20 mm electrode is inserted into the cochlea (Dorman & Wilson, 2004). Myles Kessler, Au.D.,3/20/2006 ENT Medical and Surgical Group, New Haven, CT, Audiology Online Contributing Editor - Cochlear Implants ([www.audiologyonline.com](http://www.audiologyonline.com))



**Figure 1. Threshold range for severe to profound, high-frequency sensorineural hearing loss. Note. Figure used with permission of Cochlear Corporation (A. Parkinson, personal communication, March, 2006)**



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## A Brief Look at the History of Cochlear Implants and ABI



**Dr. Rana Batterjee, Au.D., CCC-A, ASHA-F, F-AAA,**  
Clinical Audiologist

Twenty-eight years have passed since the first American child received a cochlear implant in 1980. The implant, the single-electrode system engineered at the House Ear Institute, also was the first cochlear implant to undergo U.S. Food and Drug Administration (FDA) clinical trials in adults. The first child to receive an implant in the United States in 1980 was a 10-year-old boy who was congenitally deaf and communicated exclusively through sign language. The following year, the first preschool-age child received an implant—a 3-year-old girl who had been deaf for six months due to meningitis and whose parents hoped that she would remain an oral communicator. The implantation of children was fraught with controversy and formidable adversaries. This tumultuous reaction was not surprising, however, because a similar reaction had occurred earlier with the implantation of adults.

### The Early Years of Cochlear Implantation

The FDA began regulating medical devices in 1980 and required that they undergo clinical trials to obtain marketing approval. These trials were expanded to include centers around the USA. Commercial manufacturers began to market cochlear implants and ultimately became the sponsors of large-scale, multicenter investigations. FDA clinical trials of multichannel devices followed soon after those of single-electrode systems, with pediatric trials following adult trials. At the same time, research studies were being initiated at the University of Iowa, Central Institute for the Deaf, and Indiana University School of Medicine through funding by the National Institutes of Health to determine efficacy of cochlear implants in adult and pediatric populations and to compare the different devices independently of manufacturers' claims. During the first pediatric clinical trial (with a single-electrode device), the average age at time of implant was approximately 8 years, with the majority of children communicating through sign language. From what is known today, cochlear implantation at a later age (i.e., after 4 years of age), combined with long-term auditory deprivation and little or no auditory-based language skills, does not generally result in spoken language development.

The subsequent trial with the first multichannel implant (Nucleus 22, instigated in 1986) avoided some of the shortcomings of the single-electrode investigation and required that implant teams select children with the highest potential for success. These criteria included postlingual deafness or prelingual deafness with short duration of deafness combined with a family commitment to have the child participate in oral communication educational programs. Today children with severe to profound hearing loss who meet general medical and audiological criteria are considered appropriate candidates.

### New Frontiers

The first auditory brainstem implant (ABI) was placed on the cochlear nucleus in 1979 in an adult patient with neurofibromatosis type 2. Today the ABI has become a routine surgical procedure for this specific group of adults. In December 2005, the first American child received an ABI at age 3. The actual surgery was performed in Verona, Italy, because the FDA had not yet approved this device for children. The otologist who performed the surgery, Vittorio Colletti, pioneered the procedure for non-NF2 adults and children who either are not candidates for a cochlear implant (e.g., auditory nerve agenesis) or are not successful cochlear implant users. The research team at House Ear Institute and the clinical team at Children's Hear Center in Birmingham, had an opportunity to evaluate this child in 2006. Auditory assessment was challenging because his early auditory performance was shown to be at a lower level than what is typically seen with cochlear implant recipients and was reminiscent of the early single-electrode days. Impressively, he is now showing slow but steady progress in developing auditory skills with the ABI. Discussions are underway to establish a pediatric ABI clinical trial in the USA under FDA guidelines, which may be initiated in the next several years.

It is notable that researchers in Europe have begun investigating an auditory midbrain implant in adults by placing an electrode array on the inferior colliculus in hopes that that this device might provide better performance than the ABI. If outcomes from this procedure are proven to be successful in adults, this technology might someday be applied to a select group of children.

*Eisenberg, L. S., & Johnson, K. C. (2008, March 25). Audiologic contributions to pediatric cochlear implants. The ASHA Leader, 13(4), 10-13*

## Parents' Needs Following Identification of Childhood Hearing Loss



**Nadine Ewanchyshyn, MS, S-LP (C), CCC-SLP**  
Speech Language Pathologist

The qualitative study was conducted to explore parents' needs after learning of their child's hearing loss to better understand the important components of service delivery from families' perspectives. Semi-structured interviews were conducted with 17 families of preschool children in 4 centers in Ontario, Canada. Parents were asked to share their perceptions of the strength and gaps in the care system. Results suggest that although the majority of parents were satisfied with the range and quality of audiology and therapy services available, they identified gaps in the areas of service coordination, availability of information, and the integration of social service and parents support into the system.

Conclusions cited that findings provide insights into the services most valued by families; these findings highlight the importance of eliciting parents' perspective in designing optimal care models for children and families. ➡



Historically, services for the management of pediatric hearing loss have evolved in a piecemeal fashion, with various responsibilities assumed by various agencies (health, education, social services). Recently, the Canadian Working Group on Childhood Hearing (2005) recommended the need to address management of childhood hearing loss in a comprehensive, family-oriented service delivery model.

Key components of this program include provision of standard-evidence-based audiological assessment, psychosocial support, unbiased information from a family support worker (Brown & Mackenzie, 2005; Hyde, Friedberg, Price, & Weber, 2004), and a range of communication development options from auditory-verbal to manual-based approaches.

This study “contributes to the growing evidence base in pediatric hearing health care privileging the consumers’ voice - families of children with hearing loss”. Because of the intensive and long-term nature, recognition and priority must involve a social contract with families. Parents want to be recognized as active partners in providing the optimal system of care for their child. It is important to include the parents in decision making about designing programs. In closing, Fitzpatrick et al suggest “Further understanding of parents’ needs may improve the delivery of childhood hearing services and maximize the investment in newborn hearing screening”.

*Elizabeth Fitzpatrick, Faculty of Health Sciences, University of Ottawa, Ontario, Canada, Andree Durieux-Smith, University of Ottawa and Children’s Hospital of Eastern Ontario Research Institute, Ian D. Graham and Doug Coyle, University of Ottawa and Ottawa Health Research Institute. American Journal of Audiology, VOL. 17 38-49 June 2008, American Speech-Language Hearing Association.*



## Hearing Aid Use In Conjunction With a Cochlear Implant

**Ghada Ahmad, MA, Speech-language Therapist**

Over time, the benefits of cochlear implants have been well documented in both adults and children. This has fostered an extension of cochlear implant candidacy to include patients who demonstrate greater hearing than in past years.

Patients are currently eligible to receive a cochlear implant even if they receive minimal benefit from a hearing aid in one or both ears as demonstrated by some open-set speech recognition. This has brought about an increase in the number of patients who have enough hearing in their opposite (contralateral) ear to warrant use of a hearing aid in the non-implanted ear.

### Possible Advantages

There are several possible advantages to using a hearing aid in conjunction with a cochlear implant, including improved speech perception in quiet, improved speech perception in noise, enhanced ability to localize sound (Tyler et al, 2002), and continued stimulation of the ear contralateral to the cochlear implant. Investigators who have evaluated these factors have noted better speech perception scores in quiet for some individuals when tested in a binaural (both ear) condition than when tested using either the hearing aid or cochlear implant alone (monaural conditions). In these studies, the amount of additional benefit received from the hearing aid varied and not all subjects demonstrated improvements with contralateral hearing aid use.

### Recommendations Regarding Use

Cochlear implant recipients receive a variety of recommendations regarding use of a contralateral hearing aid with a cochlear implant. Some professionals will recommend continued hearing aid use following implantation while others may recommend cessation of hearing aid use for brief or prolonged periods of time following device activation.

The amount of hearing present in the non-implanted ear will not only affect the decision regarding the most suitable ear for implantation, but will also influence the audiologist’s recommendation for continued hearing aid use following implantation. If a patient demonstrates good detection skills and/or open-set speech recognition when using a hearing aid on the non-implanted ear, it is likely that continued hearing aid use will be recommended. If such speech recognition is not possible when using an appropriately fitted hearing aid, or if patients demonstrate no benefit from or an adverse reaction to amplification, it is likely that use of the hearing aid will not improve the recipient’s ability to communicate with the cochlear implant.

If a recipient demonstrates difficulty initially in the understanding speech with the cochlear implant, use of the contralateral hearing aid may be recommended soon after device activation. This is particularly true of adults and older children who demonstrate some benefit from a hearing aid but demonstrate slow initial progress with the cochlear implant. In such instances, allowing the patient to use the hearing aid decreases the stress associated with initial cochlear implant use, and provides the patient with improved communication and comfort when compared to use of the implant alone.



## Re-Introducing the Hearing Aid

Most implant recipients readily accept the hearing aid once it is re-introduced. Recipients who receive some benefit from the aid are most likely to accept it once it is re-introduced, and are also more likely to continue using the hearing aid over the long run than recipients who receive little or no benefit from the aid.

If a child rejects the hearing aid when it is reintroduced, the audiologist should consult with the child's teacher, therapist, and parents to determine if the child is demonstrating improved performance outside the clinic setting when using both devices. If the child is old enough to participate in speech perception testing, such testing should be performed with and without the hearing aid to determine if a recommendation for continued contralateral hearing aid use should be made, even if the child is rejecting its use. If, however, the child clearly receives no benefit from the hearing aid, a recommendation to discontinue its use will be welcomed by parents who have been struggling to have their child use the hearing aid.

Research has demonstrated that use of a hearing aid facilitates progress with a cochlear implant; patients who have not used a hearing aid on their implanted ear for prolonged periods of time tend to demonstrate poorer speech recognition skills than patients who receive an implant in an ear that has recently been stimulated and has processed sound. Thus, it may be advantageous for the recipient to use a hearing aid on the contralateral ear, particularly if it provides any type of benefit, as its use may prove beneficial if a cochlear implant is recommended for that ear in the future.

By Teresa A. Zwolan [http://www.audiologyonline.com/theHearingJournal/pdfs/HJ2008\\_11\\_p54-58.pdf](http://www.audiologyonline.com/theHearingJournal/pdfs/HJ2008_11_p54-58.pdf)

## Simultaneous Bilateral Cochlear Implantation



**Dr. Omar Nazhat, MD**

Surgery is a big step for many parents of infants and young children. Parents usually have enough difficulty dealing with just having surgery done on one ear. Many will say "let's try just one ear and see how it goes", but it was found that many parents would come back and ask about doing a second cochlear implant for their children, after seeing their children struggling in the noisy environments at their schools and elsewhere.

A number of studies have now examined speech recognition ability of using bilateral cochlear implants and found that bilateral cochlear implants provide benefit for understanding speech in noise for many subjects under certain listening conditions, it was also been found to have significantly improved abilities to identify source locations.

### Why Simultaneous implantation

Both ears are implanted in the same surgery. With this option, patients only have to be in the hospital once and only go under anesthesia once. This option is much less expensive than having two separate surgeries.

### Why Should we Consider Bilateral Cochlear Implantation?

- Hearing is normally accomplished with two ears. We are born with two ears and our brains are wired to receive input from both ears
- Better localization and understanding speech in noise. Having two ears allows us to determine where sounds come from (localization), and it helps with understanding speech in background noise.
- Better sound quality, less listening effort, and other benefits. Benefits of bilateral implants appear to extend beyond sound localization and hearing in noise. Many bilateral implant recipients report better sound quality/clarity, more acoustical balance, greater ease in following group conversations, and less fatigue at the end of the day
- Never being without sound. In the unfortunate event that external equipment breaks (e.g., a cord, processor, headset) or the internal device fails, having a second implant means that the recipient never has to go without sound. This is an important consideration for adults who cannot afford to miss work because they can't hear or for children who would otherwise miss out on learning opportunities in daily life or at school