12th International Conference on Cochlear Implants and Other Implantable Auditory Technologies

Friday, May 4, 2012
Scientific Session I Oral Abstracts
8:30 AM - 10:00 AM
**Topic:** Pediatric  
**Title:** Cochlear Implants in Infants  
**Author(s):** Richard T. Miyamoto, Derek Houston, Tonya Bergeson-Dana, Bethany Colson, Jennifer Phan  
**Presenter:** Richard T. Miyamoto  
**Abstract:**
A number of surgical modifications have been incorporated over the past two decades to increase cochlear implant safety in infants. These changes have been incorporated in older children and adults as well. No complications have occurred in our infants age 6 to 12 months of age. We will describe our current technique and provide follow-up data on a series of infants who have received cochlear implants beginning in the year 2000 and compare them to older implanted children. Longitudinal language results have been recorded and will emphasize our two prototype infants who now have over 8 years of cochlear implant experience and have remained age equivalent. Data has been collected using the Reynell Developmental Language Scales, third edition; the Preschool Language Scale-4; and the Clinical Evaluation of Language Fundamentals, fourth edition in over 90 patients implanted between 6 months and 3 years of age. Very early cochlear implantation is safe and outcome measures are emerging which demonstrate an advantage.

**Learning Objective:**
Identify a number of safety features and provide beginning evidence which supports early cochlear implantation.

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**Topic:** Pediatric  
**Title:** Improving learning ability by music in children with cochlear implants  
**Author(s):** Susan Abdi  
**Presenter:** Susan Abdi  
**Abstract:**
Aim: In this study we have reviewed the feasibility and results of teaching music for implanted children. Music is found to affect the process of learning and thinking. Music develops a positive attitude in the listeners and provides them with motivation.

Material and methods: In a longitudinal study, all the children who have been undergone cochlear implantation are potential candidates for this training program compared with CI control group.

Results: All children who have entered the music training programs, have significant improvements in their daily communications as well as the desired endpoints.

Conclusions: learning ability will be improved for this group of children. Music training can be, and should be, a part of habilitation programs. We have introduced this approach 11 years ago, and know it is completely incorporated in our routine habilitation program and also in many centers in the world.

**Learning Objective:** Discuss improvements in their daily communications

**Email:** sabdi@parsonline.net
### Presentation 92

**Topic:** Pediatric

**Title:** Deaf Children with Cochlear Implants and their Families: Psychosocial Aspects

**Author(s):** Irene W. Leigh, Lauri Rush

**Presenter:** Irene W. Leigh, Lauri Rush

**Abstract:**
Currently, as reported by the major cochlear implant companies, approximately 200,000 cochlear implants have been implanted world-wide. Out of this number, 50% (approximately 100,000) have been implanted in children. This reflects a dramatic increase in terms of numbers. Consequently, the opportunity to conduct psychosocial research into how these children are adjusting has increased in various countries with sizable pediatric CI populations. Objectives: Related to the Educational/Rehabilitation section, this proposal is directed towards the category of psychosocial adjustment in young CI users: Social engagement and functioning. The objective of this presentation is to present a synopsis of current research results on the psychosocial adjustment of children with cochlear implants (Irene W. Leigh) and demonstrate through a video presentation how children with cochlear implants view their lives from a psychosocial perspective (Lauri Rush). This video presentation consists of qualitative information presented by parents and children with cochlear implants that illustrate the lives for these individuals and what factors are perceived to be conducive to maximizing the psychosocial adjustment of children with cochlear implants. We focus on children who use either spoken or signed languages, or both. Conclusion: While parents are typically led to believe that the cochlear implant will facilitate entry into hearing environments, documentation shows that total integration is a rarity even in the face of evidence that quality of life and psychosocial adjustment is positive, due in part to limited auditory access. It must be kept in mind that those children participating in research projects tend to be from families where children with cochlear implants are viewed as doing well. We have little evidence based on implanted children who are struggling socially or on implanted children from minority backgrounds. The goal is to encourage more research in this area.

**Learning Objective:** Recognize current research conclusions regarding psychosocial adjustment.

**Email:** irene.leigh@gallaudet.edu

### Presentation 93

**Topic:** Pediatric

**Title:** Children using cochlear implants who have Deaf parents: Communication outcomes for Di-CODAs.

**Author(s):** Shani Dettman, Sean French, Gabriella Constantinescu, Richard Dowell, Alex Rousset

**Presenter:** Alex Rousset

**Abstract:**
Objective. A child with normal hearing who has Deaf* parents may be referred to as a Child of a Deaf Adult, or the abbreviated CODA. (*The capital ‘D’ in Deaf delineates the social unity and cultural/linguistic identity of a subgroup of the deaf community.) The CODAs spoken language acquisition (in the absence of typical parental models of spoken language) is well documented and has prompted interesting debate about the importance of parental or other input for language acquisition. This study examines the communication development in 11 children (who have one or both Deaf parents), who are also Deaf and use cochlear implants – Di-CODAs. Method. Retrospective review of over 540 medical records from two pediatric cochlear implant centers in Australia identified 11 Di-CODA children (2 females, 9 males) suggesting a prevalence rate of 1.8%. Children completed cognitive tests, open-set word (CNC) and sentence (BKB) tests and language measures (PPVT). In addition, a questionnaire regarding parental decision-making and perspectives on cultural identity was posted to all families. Results. Speech perception and language outcomes for 11 Di-CODAs were not significantly different to outcomes reported for children using cochlear implants who have two hearing parents. Group means indicated phoneme and word scores (CNC words) of 80.2% and 57.7% respectively and sentence (BKB) understanding of 79%. Vocabulary outcomes (PPVT) indicated significant receptive language delays for 10 out of 11 children and an average delay of 18 months. The Deaf parents indicated that their children were viewed as part of both hearing and Deaf communities. In this study, all children had daily/weekly access to some spoken language models (eg. childcare, grandparents). Parents highlighted their desire for their children to have the opportunity to reach their full potential; to live and work on an equal playing field with their hearing peers.

**Learning Objective:** Counsel families who are considering cochlear implantation for their child.

**Email:** dettmans@unimelb.edu.au
**Topic:** Pediatric

**Title:** The Frequency of Caregiver “talk” with Young Children Who Are Deaf-blind with Cochlear Implants

**Author(s):** Charlotte Ruder, Kathleen Streml Thomas, Susan M Bashinski

**Presenter:** Charlotte Ruder

**Abstract:** Objective: To determine if caregivers talk more to their child after implantation as compared to pre-implant interactions.

Study Design: A multi-center study enrolled 20 deaf-blind children 12 months to <6 years of age who were receiving a cochlear implant. A battery of tests was used to assess language, development, and auditory skills including the Reynell-Zinkin Scales for Young Visually Handicapped Children. Some families also participated with Language Environment Analysis (LENA) data: three times before implantation and at least five times post implantation for a few months. A child wears the LENA device in a vest and sound information from the environment is recorded. The device was then mailed by the caregiver to the Teaching Research Institute where the auditory information was downloaded and analyzed. The LENA is used to record: the audio environment, the adult’s verbalizations, the child’s vocalizations, and turns in conversations. In addition, the LENA data yields scores for meaningful talk, distant talk, TV, noise, silence, adult words, estimated mean length of utterance, developmental age, standard score, and percentile. Results: The results are limited by the small number of pre-post child and parent dyads. Significant variability was seen in the parent interactions with their children. Some initial increase in verbal interactions by both parents after implantation was observed, but on average, no significant change pre- to post-implantation was noted. However, parent verbal interactions did increase with direct parent training. Child vocalizations and turns increased post implant, but that also was variable from time point to time point. Conclusion: LENA data needs to be collected on a larger pool of parent child dyads of children who are deaf-blind with CI. However, this preliminary data suggests that parents may need coaching and treatment strategies to increase the auditory and verbal interactions during daily routines with their children.

**Learning Objective:** Describe the collection procedure and data available using the Language Environment Analysis (LENA) technology.

**Email:** charlotte.ruder@cchmc.org

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**Learning Objective:** Identify range of potential audiological outcomes that patients with CHARGE Syndrome who receive cochlear implants may demonstrate.

**Email:** nyoung@childrensmemorial.org
Changes in Maternal Sensitivity Over Three Years Post-Implantation

**Objectives:** The current study evaluated changes in maternal sensitivity (MS) in a large, national sample of young deaf children receiving cochlear implants and hearing controls. Study Design: Children were part of the Childhood Development after Cochlear Implantation study, a multi-site, longitudinal study of 188 severe-to-profoundly deaf children who received cochlear implants (CI; mean age 2.2 years) and 97 hearing controls (NH; mean age 2.3 years). Assessments were performed prior to implantation and at 6, 12, 24, and 36 months post-implantation. MS was measured during three videotaped parent-child interaction tasks lasting 20 minutes: Free Play, Puzzle-Solving, and Art Gallery. Interactions were coded using the NICHD Early Childhood Study codes, including a composite score (sensitivity, respect for autonomy, positive regard, hostility) rated on a 7-point scale. Results: Multilevel modeling examined how MS changed across time and across tasks. Results suggested that parents of NH versus CI children showed significantly more sensitivity at baseline (F(1,1280) = 12.84, p < .01). Sensitivity in both groups remained relatively constant over time and the pattern of results did not differ by task. The subscales showed a pattern that was similar to the composite with a few exceptions. On the scale Respect for Autonomy, parents of younger compared to older children started lower (F(1,281) = 6.21, p = .01) but improved over time, whereas parents of older children’s scores were constant across time (F(1,267) = 4.11, p = .04). In addition, parents in the CI versus NH group showed greater improvements over time in the Puzzle-Solving task relative to Free Play and Art Gallery (F(2,3920) = 3.10, p = .05). Conclusion: Given that MS remains fairly constant over time and is an important predictor of growth in oral language (Niparko et al., 2010), future studies should focus on developing interventions to improve MS in parents of hearing impaired children.

**Learning Objective:** Describe ways of evaluating parental sensitivity in parents of hearing impaired children.

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Cochlear implantation in single sided deafness: Speech perception in noise and localization of sound sources—a longitudinal study

**Objectives:** Cochlear implantation in single sided deafness (SSD) aims at restoration of binaural hearing by providing auditory input from both sides. A cross-sectional study of experienced SSD cochlear implant (CI) users showed encouraging results for speech perception in noise and localization of sound sources. However, little is known about the time course of the restoration of binaural hearing abilities in SSD patients. Study design: So far fourteen adult users of a MED-EL cochlear implant were included in this single subject repeated measures study. Speech perception in noise was evaluated with HSM sentences and Freiburg monosyllables in CCITT noise as well as OLSA sentences in competing 2-talker babble. Speech was presented from the front while noise was directed from the normal hearing ear. Localization ability in the frontal horizontal plane was assessed with a 1s CCITT noise stimulus in a nine equally spaced loudspeaker array. Data was collected at first fitting as well as after 1, 3, 6 and 12 months. All tests were conducted in NH (normal hearing ear) alone and CI+NH conditions. Results: Performance in the CI+NH condition varied greatly immediately after the first activation of the device. However, substantial benefits became evident after some binaural hearing experience. While significant improvement of localization abilities could be observed very early, speech perception in noise required more experience. A steady increase of performance was seen during the first year after first activation of the CI. Conclusion: While improvement of speech perception might require some hearing experience, localization ability seems to be restored quickly after cochlear implantation in single sided deafness, thus providing early benefits in difficult acoustic situations in daily life.

**Learning Objective:** Assess Cochlear implantation to restore binaural hearing in non-tinnitus subjects with single sided deafness.

**Email:** harnisch_w@klinik.uni-wuerzburg.de
Objectives: Children with unilateral deafness (single sided deafness, SSD) suffer from difficulties in speech comprehension in noise particularly at school and from sound localization. There are different conventional options for auditory rehabilitation of children as well as adults with SSD, CROS hearing aids and bone-anchored hearing (BAHA) aids. The quite new treatment of SSD with a cochlear implant has been shown to be very successful in adult patients (Vermeire et al 2009, Buechner et al. 2010, Arndt et al. 2011). Will children with SSD benefit from a cochlear implant, too? Study Design: So far three children with SSD have been implanted with a cochlear implant at an age of 4.5, 10.2, and 11.7 years, respectively. Hearing abilities were assessed in the two elder children unaided before implantation and binaurally with the cochlear implant 12 months after CI switch on. Speech discrimination in noise was measured using the Hochmair-Schulz-Moser (HSM) sentence test for 3 different presentation conditions at speech and noise levels both fixed at 65 dB SPL. Additionally, speech discrimination in noise thresholds were evaluated using the Oldenburg sentence (olsa) test. Localization was assessed using an array of 7 speakers at head level in a frontal semicircle. Stimuli consisted of olsa sentences presented at 65 dB SPL. Furthermore, the Speech Spatial and Qualities of Hearing (SSQ) questionnaire was administered to the children and their parents to measure (self-)reported auditory disability. Results: The children show a significant improvement in localization and in speech in noise discrimination in most presentation conditions for binaural hearing with the cochlear implant compared to the unaided situation. They and their parents also (self-)report a definite improvement for binaural hearing with the cochlear implant. Conclusion: Not only adults, but also children with SSD profit significantly from rehabilitation with a cochlear implant.
Presentation 100

**Topic:** Unilateral/Single Sided Deafness

**Title:** Cochlear implantation in single-sided deafness

**Author(s):** Paul Van de Heyning, Andrea Kleine Punte

**Presenter:** Paul Van de Heyning

**Abstract:**

Objectives: to report on binaural hearing with CI in single sided deafness (SSD)

Study Design: CI was performed in 29 patients with postlingual SSD and severe tinnitus of less than 10 years. Long-term follow-up data are available in 22 of these patients. 12 patients have normal hearing contralaterally (NH group) and 10 patients use a hearing aid in the non-implanted ear (HA group). Speech reception in noise was assessed in three spatial configurations (S0N0, S0NCI, SCIN0) with the CI off and the CI on. Subjective improvement in daily situations was evaluated using the Speech, Spatial and Qualities of Hearing Scale (SSQ). Evaluations were followed up 36 months post fitting.

Results: Speech reception in noise improved significantly in both groups of patients after CI. 36 months after first fitting a binaural summation effect of 1.6 dB in the NH group and 3.5 dB in the HA group was measured. Binaural Squelch was 2.1 dB and 4.0 dB in the NH- and HA group respectively. A combined Head Shadow effect and Squelch effect of 2.4 (NH group) and 6.7 dB (HA group) was found. Scores on the SSQ also showed significant improvement after CI in both groups, except for the space subscale of the HA group.

Conclusions: CI can restore binaural hearing after 36 months of use of a CI in patients with SSD.

**Learning Objective:** Discuss if CI improves speech recognition in different speech-in-noise conditions in patients with postlingual single sided deafness.

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Presentation 101

**Topic:** Unilateral/Single Sided Deafness

**Title:** Improving the Accuracy of Baha Sound Processor Fittings: Measuring Direct Bone Conduction: A multicenter study.

**Author(s):** Andre Sadeghi, Mark Flynn, Tom Davison, Steen Ostergaard Olsen, Michael Schulte, Martin Hillbratt

**Presenter:** Mark Flynn

**Abstract:**

Purpose: Variability in Baha sound processor fittings arises from the nature of the implant-to-bone transmission and in addition transcranial attenuation for patients with single-sided sensorineural deafness. One method of improving the predictability of Baha® fittings is to measure the individual patient’s actual bone conduction thresholds, thereby removing the influences of skin thickness and/or implant location site.

Materials and Method: One hundred thirty eight adult wearers of the Baha System participated in the study. Direct bone conduction thresholds were obtained through the BC Direct feature of the Cochlear™ Baha® Fitting Software combined with the Cochlear Baha BP100 sound processor. Results: The results confirm the improved transmission of sound through the implant rather than transcutaneously through the skin. On average, the BC Direct thresholds were closer to the patient’s unmasked thresholds than the masked values. In subjects with SSD, BC Direct results were elevated when compared to the contralateral bone conduction thresholds due to the transcranial attenuation. The test-retest reliability for the BC Direct measurements was within +/- 5 dB, which is in within the accepted variability for audiometric test measurements. The comparison of preferred amplification, based on direct bone conduction or bone conduction audiometry, found higher agreement for fittings based on direct bone conduction measurements.

Conclusion: On average the transfer function between the implant and the skin can be predicted, however, there are a number of patients for whom direct measuring is essential for determining the required amplification. These were patients with: (1) SSD; (2) asymmetrical hearing loss; (3) unusual implant location or skull formation; and, (4) users of Testband or Softband. The result for the clinician, is that Baha fitting when combined with direct measurements of bone conduction, may require less fine-tuning and provide a greater understanding of the variability of the bone conduction sound pathway.

**Learning Objective:** Assess if the BC Direct provides accurate measurements of bone conduction thresholds as the basis for Baha fitting.

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### Presentation 102

**Topic:** Unilateral/Single Sided Deafness  
**Title:** Within-subject comparisons of speech perception in quiet and in noise for patients with single-sided deafness fitted with the BP100 and Ponto osseointegrated implant speech processors  
**Author(s):** Sigfrid Soli, William Slattery, William Luxford, Andrew Vermiglio  
**Presenter:** Sigfrid Soli  
**Abstract:**  
Purpose: Patients with single-sided deafness (SSD) can receive an osseointegrated implant contralateral to their hearing ear that provides transcranial bone conducted stimulation to the hearing ear in combination with normal air conducted stimulation. These combined inputs can partially overcome the effects of headshadow attenuation of sound sources contralateral to the hearing ear, improving speech intelligibility in quiet and in noise under certain conditions. The benefits of these combined inputs depend, in part, on the performance of the speech processor. This study compares within subjects the performance benefits of the BP100 processor manufactured by Cochlear Ltd. and the Ponto processor manufactured by Oticon Medical.  
Method: A total of 12 osseointegrated implant recipients from the House Clinic currently using Divino speech processors participated in the within-subject study. HINT thresholds in quiet and in noise were measured under a variety of conditions to assess the headshadow benefits of both speech processors. Additional HINT tests in diffuse noise were used to evaluate the benefits of each processor’s directional microphone. Subjects also completed a Hearing Device Satisfaction Survey after field trials of 3 weeks or more with each processor.  
Results: Results will be analyzed to determine the benefits of each processor in difficult quiet listening situations, as well as headshadow benefits in noisy situations. The analyses will also examine the benefits of directional microphones. For each analysis, the benefits of the processors alone will be isolated using test results obtained with the hearing ear occluded. These measures from the laboratory will be combined with the Survey results to provide an overall picture of the performance benefits of both processors.  
Conclusion: The results of this study can provide useful information both to health care professionals and to patients about the relative benefits of each processor, based on the well-controlled design of the study.  

**Learning Objective:** Recognize potential benefits of osseointegrated implants for patients with single-sided deafness  
**Email:** ssoli@hei.org

### Presentation 103

**Topic:** Unilateral/Single Sided Deafness  
**Title:** Spontaneous Unilateral Hearing Recovery in Bilateral Meniere’s Disease: An Unusual Scenario of Cochlear Implantation in Single Sided Deafness  
**Author(s):** Brian John McKinnon, John Neiner  
**Presenter:** John Neiner  
**Abstract:**  
Objectives: Cochlear implants have advanced to the point where there is consideration of implanting patients with greater and greater residual hearing or in those with single sided deafness. Little literature exists evaluating the specific role of cochlear implants in Meniere’s Disease (MD). We present the unique case of a male with history of MD and severe bilateral hearing loss who after unilateral cochlear implantation had significant functional improvement in the contralateral unimplanted ear, and in binaural hearing as well. We then discuss this case in light of the current data on cochlear implants in Meniere’s Disease and in single sided deafness.  
Study Design: A case report  
Results: Post implantation, hearing in noise test in quiet and in noise improved from 22% to 100% and 0% to 63%, respectively. CNC improved from 26% to 83%. Speech discrimination improved from 64% at 100dB preimplantation to 76% at 60dB postimplantation. Contralaterally, in the non-implanted ear, SRT improved from 80dB to 20dB and he was able to discontinue hearing aid use on that side.  
Conclusion: The patient achieved better than expected outcome, particularly with respect to his native hearing contralateral to his cochlear implant. More research should be performed to analyze the role of CIs in Meniere’s Disease and in single sided deafness.  

**Learning Objective:** Recall current indications for cochlear implants  
**Email:** brmckinnon@georgiahealth.edu
Topic: Medical I
Title: Complications and Failures of Cochlear Implantation in 540 Recipients at Apollo Health City, India
Author(s): EC Vinay Kumar
Presenter: EC Vinay Kumar
Abstract:
INTRODUCTION: Cochlear implantation is a relatively safe surgery performed on severe to profound bilateral hearing loss patients. Its surgical indications have increased and the age of implantation has decreased over the last years. As like other ear surgeries, it presents complications; device failure is one of the most important, given its potential risk for the need to explant and reimplant the device.
OBJECTIVE: To evaluate cochlear implant complications & failures to determine possible causes and discuss medical and surgical management.
MATERIAL AND METHODS: A retrospective study of cochlear implants was performed. A total of 540 implants for a period of 1994-2011 were evaluated. The sample consisted of 495 Pre-lingual and 50 postlingual, 309 male and 231 female, 503 children below 18 years and 37 adults above 18 years, 522 unilateral and 9 bilateral subjects, 387 normal anatomy and 153 abnormal ears were taken in the present study. The devices implanted were 487 Cochlear, 40 Advance Bionics, and 13 MED-El. Complications and device failures were analysed.
RESULTS: The overall rate of complications was 7.9 % (44 of 540), with 32 minor complications accounting for 5.9%; 9 major complications, 1.67 %; and 3 reimplantations, 0.55 %. Reasons for revision surgery were device failure, infection. Revision surgery was performed in 3 of the 540 cases (0.55 %), Device failure occurred in 2 out of 540; 0.37 %) The risk of severe infection (eventually requiring explantation) was 0.18 % (1 of 540), 2 failure to implant (0.37%) and subsequently implant on contralateral side, 2 permanenten facial palsy (0.37%), 1 re exploration (0.18%) and 1 post-meningitis (0.18%) were occurred. The minor complications include 11 temporary facial palsy (2.03%), 10 wound infections due to magnet strength(1.85%), 6 CSF gushers (one needed CLD) (1.11%), 2 CSOM (0.37%), 1 cholesteatoma (0.18%), 2 device related issues (0.37%) were observed, all were treated.

Learning Objective:
Assess that cochlear implantation is a safe technique with a relatively low complication rate; however, certain complications may require specific attention to prevent or correct them.

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Friday (8:30 AM - 10:00 AM) Four Seasons Grand Ballroom

Topic: Medical I
Title: Multichannel Cochlear Implant Technical and Medical Failure Analysis in Large Series
Author(s): Juan A. Chiossone, Edgar Chiossone, Stefania Goncalves
Presenter: Juan A. Chiossone
Abstract:
Introduction: Cochlear implantation is relatively a safety surgery with a low rate of complications, which indication is toward patients with Neurosensorial Hearing Loss being children or adults. Even though, when complications occur, it can be difficult to manage. According to Cohen (1995), this can be minors or majors complication, depending on whether if patients need second intervention. Some references estates 5 - 13% complications, being hard failure the main cause, according to Cohen (2004).

Objectives: To present the statistics of the Fundación Venezolana de Otología (FVO) related to technical versus medical failures, which takes to cochlear implants extraction.

Materials and Methods: Clinical cases retrospective study. Statistical analysis using variables related to cochlear implant type and the beginning of the complication symptoms.

Results: From about 703 patients, only 26 had presented complications related to the implant. 15 underwent second surgery to cochlear implant extraction due to extrusion, 3 due to technical failures, 2 electrode misplacement, 5 patients showed intermittent function with out suffering second surgery, 1 deceased. Analysis related to manufacturers are presented with survival rate in our series and statistically compared with industry data. Microbiological data is also presented in extrusion cases.

Learning Objective:
Recognize how the failure data can be presented

Email: jchiossonek@gmail.com
Objectives: Electrode impedance measures are one component of intraoperative cochlear implant testing that is used to verify device and electrode function. If a large number of electrodes present with short/open circuits intraoperatively, decisions must be made regarding whether or not to use a back-up device. However, it is not uncommon for abnormal intraoperative impedances, particularly open circuits, to resolve by the time of the initial activation. The goal of this retrospective study was to (1) assess the incidence of individual electrode malfunction at the intraoperative interval, (2) to determine the likelihood that intraoperative electrode malfunctions resolve spontaneously, and (3) to determine the incidence of abnormal impedance postoperatively following normal impedance measures intraoperatively. This information may guide clinical decisions regarding whether or not to use a back-up device based on intraoperative impedances.

Study Design: Data were obtained via a retrospective records review. To date, intraoperative and postoperative (initial stimulation only) impedance measures have been obtained for 2638 electrodes in 151 ears (N = 37 Cochlear, N = 114 AB). Results: Of 2638 electrodes, 2560 (97%) had normal impedances intraoperatively and postoperatively. Intraoperatively, 72 (2.7%) electrodes presented with abnormal impedance. There were six electrodes with normal intraoperative impedance that presented as abnormal impedance postoperatively following normal impedance measures intraoperatively. However, it is not uncommon for abnormal intraoperative impedances, particularly open circuits, to resolve by the time of the initial activation. The goal of this retrospective study was to (1) assess the incidence of individual electrode malfunction at the intraoperative interval, (2) to determine the likelihood that intraoperative electrode malfunctions resolve spontaneously, and (3) to determine the incidence of abnormal impedance postoperatively following normal impedance measures intraoperatively. This information may guide clinical decisions regarding whether or not to use a back-up device based on intraoperative impedances.

Conclusion: There is evidence of significant effort being made to delineate incidents with complex origins, however surprisingly little next to no published research is looking into the role of ‘intrinsic’ factors in such incidents. Analysis of MAUDE reports indicates a growing need to investigate the influence of individual biological factors such as age, immunity and general wellness on patient outcomes.
### Presentation 108
**Friday (8:30 AM - 10:00 AM) Four Seasons Grand Ballroom**

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<th>Topic:</th>
<th>Medical I</th>
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<tr>
<td>Title:</td>
<td>Cochlear Implantation in Patients with X-Linked Deafness: Radiographic Findings, Surgical Techniques, and Outcomes</td>
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<tr>
<td>Author(s):</td>
<td>Selena Heman-Ackah, Maura Cosetti, David Friedmann, Ronen Perez, Susan Waltzman, John Thomas Roland</td>
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<td>Presenter:</td>
<td>Selena Heman-Ackah</td>
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<tr>
<td>Abstract:</td>
<td>Objectives: X-linked deafness is a potential etiology of sensorineural hearing loss characterized by bulbous dilatation of the fundus of the internal auditory canal (IAC) and the absence of the bony plates separating the basal turn of the cochlea and IAC. These malformations predispose patients with X-linked deafness to IAC insertion during CI. The objective of this presentation is to describe associated audiometric presentation, surgical techniques, and CI performance in patients with X-linked deafness. Study Design: Case series. Methods: A retrospective chart review was performed of all patients at a tertiary care facility who underwent CI between January 2006 and July 2011. Results: A total of 4 patients were identified with characteristic radiographic findings of X-linked deafness. Audiometric findings at presentation were described. A modified cochleostomy was utilized to ensure electrode insertion within the scala tympani avoiding the internal auditory canal. Fluoroscopy was utilized to visual electrode progression during insertion. Complete insertion was accomplished in all patients. Cochlear implant performance for each patient was detailed. Conclusions: Utilizing the techniques described, patients with X-linked deafness may successfully undergo CI with excellent potential for auditory rehabilitation.</td>
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**Learning Objective:** Describe the potential audiological presentation of patients with X-linked deafness.  
**Email:** selena.heman-ackah@nyumc.org

### Presentation 109

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<th>Topic:</th>
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<tbody>
<tr>
<td>Title:</td>
<td>From Bilateral-Bimodal Hearing (CI/HA) to Bilateral Implantation (CI/CI) – a Step towards an 'Evidenced Based Decision Making Process'</td>
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<tr>
<td>Author(s):</td>
<td>Michal Luntz, Talma Shpak, Noam Yehudai, Tova Most</td>
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<td>Presenter:</td>
<td>Michal Luntz</td>
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<tr>
<td>Abstract:</td>
<td>Introduction: 'Bimodal advantage' stems from the addition of low frequencies acoustic hearing (HA) to the high frequencies electric hearing (CI). Outcomes of bilateral CI (CI/CI) are good but individual results vary. Also, it is not yet possible to guaranty acoustic hearing preservation during CI surgery. Therefore turning a CI/HA user into a CI/CI or CI/CI-HA user should be done sensibly. Objectives: To design a sensitive battery of tests for bimodal advantage evaluation. Patients and methods: CI alone and CI/HA conditions were compared in 29 good CI/HA users with a test battery composed of seven bimodal advantage task specific tests. The tests were scaled according to their relative strength using the Partial Eta Square ($\eta^2_p$) Analysis. Results: Significant advantage in favor of the CI/HA condition over the CI alone condition was found as expected in all five tests. Partial eta square ($\eta^2_p$) analysis values for the tests ranged between 0.489 and 0.876, with the largest value for the tests that evaluated the difference between recognition of natural prosody and flattened F0 sentences and the test that evaluated the ability to percept semantically unpredictable sentences from reversed speech when the masker was a female talker (with customized SNR, 0, +5 or +10dB). The administration time for these two tests was 30 minutes. Discussion: Bimodal advantage can be evaluated in the clinical setting. Routine use of bimodal advantage task specific tests may lead to an evidenced based decision making process regarding turning a CI/HA user into a CI/CI or into a CI/CI-HA user that stems specifically from a deterioration of bimodal function.</td>
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**Learning Objective:** Periodically monitor the performance of a bimodal-bilateral user with task specific tests is recommended  
**Email:** michal.luntz@b-zion.org.il
**Friday (8:30 AM - 10:00 AM) Four Seasons Grand Ballroom**

**Presentation 110**

**Topic:** Medical I  
**Title:** Hearing preservation – data with atraumatic cochlear implant electrode  
**Author(s):** Thomas Lenarz  
**Presenter:** Thomas Lenarz  

**Abstract:**
Introduction: The additional use of low frequency residual hearing has shown to improve the performance in cochlear implant patients significantly especially in difficult listening environments. In order to identify factors that contribute to the postoperative hearing loss the length of the active electrode array has to be taken into consideration. Both, the Hybrid-L and the CI422 electrode are designed to preserve residual hearing. The main difference of both electrodes is the length of the active electrode array (14.5 vs 20 mm). Objective: The effect of different electrode designs to preserve residual hearing is evaluated with respect to the stability of the residual hearing postoperative over time. Methods: Subjects with severe to profound sensorineural hearing loss and substantial residual hearing across frequencies with more pronounced residual hearing in the low frequencies have been implanted at the MHH with either Hybrid-L (N=140) or CI422 (N=130) electrode. A single subject design with repeated measures of unaided pure tone thresholds was used and the results for the different atraumatic electrodes with respect to median and mean hearing loss across frequencies and number of patients with total hearing loss were compared. Results: The mean hearing loss at the time of Initial Activation and 6 months postoperative was 10 dB for the Hybrid-L (N=91) and 17 dB for the CI422 (N=66) electrode over the frequency range from 125 to 1500 Hz. The total number of patients with a loss of greater than 30 dB at Initial Activation was N=7 (10.2%) and 3 patients showed a delayed hearing loss over time. Conclusion: The results indicate that residual hearing can be preserved with both Hybrid-L and CI422 electrodes with the larger median loss for the CI422 compared to the Hybrid-L electrode. This indicates that the length of an electrode besides other factors plays an important role for hearing preserving cochlear implantation.

**Learning Objective:** Identify the type of electrode to be used should be chosen on the level of preoperative residual hearing.

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**Friday (8:30 AM - 10:00 AM) Marriott Waterview Ballroom**

**Presentation 111**

**Topic:** Outcomes I  
**Title:** Choice of brand of Cochlear Implants for adults. Remarks on our selection criteria. Discussion based on 164 CI patients.  
**Author(s):** Christine Poncet-Wallet, Esther HARBOUN-COHEN, Emilie Ernst, Yves Ormezzano, Bruno Frachet, Emilie Vormes  
**Presenter:** Christine Poncet-Wallet  

**Abstract:**
Motivation: Four providers of Cochlear Implants currently share the marketplace in France: Advanced Bionics, Cochlear, Medel, and Neurelec. This study examines how we assign a brand to a patient. Our goal is not to evaluate the performance by brand or lead to a ranking, it is a way of formalizing the criteria considered by the team and their respective weight in the final decision on the brand choice. Is it possible to make a random choice or to follow a decision grid established according to specific criteria? Problem statement: -Can the choice be guided by the manufacturers’s sales strategies? By objective differences in the outcome of auditory rehabilitation depending on the brand? -Can it be completely randomized? – Whilst making the decision, what are the respective weight of the surgeon’s advice, of the fitting ENT’s, of the patient’s choice, of the associations, of the suppliers? Approach: The CRIC monitors and follows up all cochlear implants in Paris and its region. In this study, we focus on a cohort of 164 adult patients (81 women, 83 men, 16 y.-84 y. old, mean age 54,05) whose decision on the brand was made by a single team (i.e. Hôpital Avicenne). Results: In this retrospective study, it appears that the criteria for choosing a brand are not related to the technical nature of the implants nor to the signal processing strategies, but rather to elements regarding 'details'. Conclusions: We aim to make a critical review of our practice, not to offer turnkey solutions for choosing a brand. We are aware that our conclusions are made for the time being, and are by definition subject to change over the course of time. The rehabilitation will be more efficient if each partner, patient, surgeon, clinician, and speech-therapist is convinced that only the best choice has been made.

**Learning Objective:** Recognize that objective criteria are not always available

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Objectives

To obtain hearing benefits after cochlear implantation it is crucial to optimally fit the system to the individual need of every patient. Great variability between patients and the fact, that optimal values change in time make this a difficult task. In the Institute of Physiology and Pathology of Hearing, fitting procedure that contains many psychophysics and objective measurements was introduced to assure optimal fitting of the system. However, it is still very interesting to find out, how non-optimal fitting may influence hearing benefits, especially when the error is relatively small.

Study Design

Material of the study consists of 61 patients. In 3 experiments, some characteristic of the patient’s program: loudness, balance, threshold were non-optimally changed. The results of speech comprehension tests obtained on those programs were compared to those obtained on optimal map.

Results

Unexpectedly big deteriorations of hearing benefits were observed after relatively small change in electrical stimulation values. In quiet, the average worsening in speech comprehension tests was as large as 16% when balance was change, and 14% when loudness changes. In noise, those values are respectively 16% and 18%.

Conclusions

The results prove that it’s very important to find best possible values of electrical stimulation parameters. Even slight error can worsen the patient’s results by larger degree that it was assumed.
Topic: Outcomes I
Title: Speech recognition in Reverberation by Cochlear Implant users
Author(s): Roland Mühler, Michael Ziese, Dorothea Rostalski, Jesko Verhey
Presenter: Roland Mühler
Abstract: Objectives: Reverberation is one of the most detrimental sound characteristic cochlear implant users are facing in routine hearing environments. Previous research in our laboratory using speech tests in quiet and noise has demonstrated that significantly lower speech recognition scores were achieved for reverberated conditions in comparison to the not reverberated condition. The aim of the present study was to investigate the influence of pre-processing algorithms on the speech recognition score for reverberated speech in noise.
Study Design: Speech samples from the German Oldenburg Sentence Test (OLSA) were processed with professional audio editing software (WaveLab 6, Steinberg, and VST plug-in NaturalVerb). Reverberated speech samples at several levels of reverberation time (RT60 = 0.5, 0.8, 1.0, 1.3s) were generated and stored on disk. Adaptive speech intelligibility tests (OLSA) were performed in postlingually deafened adult CI users wearing Nucleus Freedom or CP810 sound processors. Speech reception thresholds (SRTs) were measured for different levels of reverberation time and for SmartSound(TM) settings "Everyday" and "Noise".
Results: A significant influence of reverberation time on the SRT was found in all subjects. An effect of the pre-processing algorithm, which we have seen in some of the subjects, was not statistically significant.
Conclusions: The detrimental effects of reverberation on the speech perception in cochlear implant users can be evaluated accurately by adaptive speech tests in noise using reverberated speech samples. SRTs for reverberated speech could be used to further quantify expected positive effects of pre-processing algorithms as e.g. SmartSound(TM).

Learning Objective: Recognize the intelligibility of speech in rooms is affected by reverberation. Reverberation has a substantial impact on the speech perception abilities of CI users.

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Topic: Outcomes I
Title: Benefit of a binaural directional microphone for Cochlear Implant Users in a diffuse noise field
Author(s): Andreas Buechner, Karl-Heinz Dyballa, Stefan Fredelake, Phillip Hehrmann, Volkmar Hamacher, Thomas Lenarz
Presenter: Andreas Buechner
Abstract: Adaptive beamforming microphone systems have been used in conventional hearing aids since the late nineties, where they provide useful advantages in difficult listening environments. In this study, a new binaural beamformer system being used in top-class Phonak hearing aids was investigated, which can compute a very narrow, front-facing beam by wirelessly linking the dual microphone systems of the left and right hearing aid. 12 experienced users of the Harmony sound processor with HiRes 120 were enrolled, 5 of them bilaterally implanted. In case of bilateral implantation, only the leading ear was investigated. During the test sessions, the subjects used state of the art hearing aids on each side which communicated via a wireless link. The output of the hearing aids was converted to an analog signal and fed into the external input of the Harmony CI processor. Speech intelligibility was assessed using the Oldenburg sentence test with the noise presented at 65 dB from five loudspeakers positioned in ±70°, ±135° and 180° angles. Speech was presented from the front loudspeaker and the level was adapted to achieve the speech reception threshold (SRT50). Furthermore, the omnidirectional and the adaptive directional microphone of the same hearing aid were also evaluated for comparison. The single-sided adaptive beamformer led to a significant improvement of 5 dB for the SRT compared to the omnidirectional microphone, while 7 dB were achieved with the binaural beamformer. Results of the binaural beamformer promise further benefit compared to a beamformer based on one hearing device only. The introduction of this technology in next generation CI processors would allow binaural beamforming either between two CI processors or between CI processors and a contralateral hearing aid equipped with the wireless technology. Therefore it is especially interesting for bilaterally implanted or bimodally fitted patients.

Learning Objective: Assess that hearing in noise can be improved using advanced processing technology.

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**Topic:** Outcomes I
**Title:** Use of the AzBio Sentence Test to Measure Post-Operative Speech Perception Performance to Avoid Ceiling Effects in Cochlear Implant Recipients

**Author(s):** Jonathan Myungsso Lee, David Gudis, Michelle Montes, Jennifer Rotz, Douglas Bigelow, Michael Ruckenstein

**Presenter:** Jonathan Myungsso Lee

**Abstract:** Objectives: The goal of this study was to assess the post-operative speech perception abilities of cochlear implant recipients. Our intention was to determine whether the Hearing in Noise Test (HINT) was limited by significant ceiling effects, and to evaluate whether the AzBio Sentence Test was a better measure of post-operative speech perception performance. Study Design: The study design was a retrospective chart review of pre- and post-operative speech perception performance for 120 adult cochlear implant recipients at a tertiary academic center over a two year period. Patients were evaluated with a variety of speech perception tests, including the HINT and AzBio sentence tests and the CNC word test. Results: For HINT sentences in quiet, 21.1% of the subjects tested achieved a maximum score of 100% correct, compared to 0.0% for the more difficult AzBio sentence test in quiet. 42.3% of subjects scored greater than 90% correct on the HINT sentences, while only 15.7% of subjects scored greater than 90% on the AzBio sentences. The overall mean HINT score was 75.9, and the mean AzBio score was 54.7. For the 36 patients who had full pre- and post-operative AzBio data available, there was a mean implant-ear benefit of 44 percentage points. Conclusion: This study supports previous work by Gifford et al. (2008), demonstrating that the HINT sentences suffer from significant ceiling effects. As a more difficult test, the AzBio sentence test is not subject to the same limitations and may be a better measure to track the post-operative speech perception performance of high-performing cochlear implant recipients.

**Learning Objective:** Identify the common speech perception tests used for pre- and post-operative evaluation of cochlear implant recipients

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**Friday (8:30 AM - 10:00 AM) Marriott Waterview Ballroom**

**Topic:** Outcomes I
**Title:** Speech Perception Outcomes after Cochlear Implantation in Older Adults

**Author(s):** Frank Lin, Wade Chien, Lingsheng Li, John Niparko, Howard Francis

**Presenter:** Frank Lin

**Abstract:** OBJECTIVE: To determine the impact of cochlear implantation (CI) on speech perception scores in older adults and to identify factors associated with speech outcomes after CI. METHODS: The Johns Hopkins Listening Center maintains a prospective database of the pre- and post-CI speech scores of all patients undergoing CI at Johns Hopkins. We queried this database to ascertain all individuals =60 years who underwent a first CI from 1999-2011 and who underwent HINT sentence testing in quiet both before and 1 year after CI. Linear regression was used to model the association of independent variables (age at CI, pre-operative speech scores) with HINT speech scores after adjusting for potential confounders. RESULTS: There were 83 participants = 60 years with complete pre- and 1 year post-CI HINT speech scores. All participants demonstrated gains in speech scores over 1 year with a mean improvement in HINT scores of 60.0% (S.D. 24.1). The magnitude of the gain in speech scores was negatively associated with age at implantation such that for every increasing year of age at CI the average gain in speech scores was 1.3 percentage points less (95% CI: 0.6 – 1.9) after adjusting for age at hearing loss onset. Conversely, individuals with higher pre-CI speech scores (HINT scores between 40-60%) had significantly greater post-CI speech scores by a mean of 10.0 percentage points (95% CI: 0.4 – 19.6) than those with lower pre-CI speech scores (HINT <40%) after adjusting for age at CI and age at hearing loss onset. CONCLUSION: CI in older adults is consistently associated with gains in speech perception. Our results suggest that CI candidates who are younger at implantation and with higher preoperative speech scores may derive the greatest benefit from cochlear implantation with possible implications for current Medicare policy.

**Learning Objective:** Assess the impact of cochlear implants on the speech perception abilities of older adults

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