**CI2023 Dallas: Cochlear Implants in Children and Adults**

**Poster Exhibit Abstract**

**Poster Category:** Audiology

**Poster Exhibit Number:** 1  
**Student Poster Competition?**

**Abstract Number:** 20

**Poster/Abstract Title:** Cognitive functions and subjective evaluation of hearing in cochlear implant users

**Abstract Content:**

**Introduction:** Cochlear implantation (CI) is an effective treatment of severe-to-profound hearing loss, but the clinical outcomes vary substantially across patients. This variability may be attributed to the variation of both bottom-up sensory representation of sound features and top-down cognitive abilities. This study aimed to examine the cognitive function in different domains (memory, attention, executive function etc.) in CI users and to explore the correlation between the cognitive score and subjective hearing ability. Methods: Forty-two CI users were surveyed including those wearing a CI unilaterally (UCI), bilaterally (BCI), and a hearing aid in the non-implanted ear (Bimodal). Research Electronic Data Capture (REDCap) was used to collect the following data: CI demographic data and self-evaluation of hearing ability; participants also had the opportunity to perform web-based self-testing of cognitive tests via BrainCheck online platform. In addition, ten young normal-hearing (NH) young listeners participated in cognitive tests to provide normative reference. Results: CI users’ scores in executive functions (Stroop Test and Digit Symbol Substitution Test) and visual attention (Trails A/B Tests) were significantly poorer than NH listeners (p<0.05). The scores in memory domain (Immediate recognition, Delayed recognition) were similar in the two groups. Most BCI and Bimodal users expressed better binaural hearing than monaural hearing. For BCI users who were sequentially implanted, the ear difference in subjective hearing existed between the 1st and 2nd CI (p < 0.05). BCI users had a greater subjective binaural benefit than Bimodal users, with the latter group having a higher probability of subjective ear difference in loudness and pitch when listening to sounds in front of them. The Composite cognitive score across domains tended to be related to subjective hearing (p = 0.07), after adjusting for the age at implantation, a demographic factor that significantly affected subjective hearing (p < 0.05). Conclusion: CI users have differential cognitive deficits beyond the memory level. This study provide evidence that BrainCheck online platform can be used for CI users as a convenient and effective way to self-evaluate cognitive function, one aspect of CI benefits typically not captured by clinicians.

**Primary Author/Presenter:** Fawen Zhang

**Author Block:** Fawen Zhang, PhD1, Kelli McGuire, AuD1, Madeline Skeeters, BS1, Matthew Barbara, BS1, Pamara Chang, PhD2, Nanhua Zhang, PhD3, Jing Xiang, PhD4; 1Communication Sciences and Disorders, Univ. of Cincinnati, Cincinnati, OH, 2Department of Information & Logistics Technology, Univ. of Houston, Houston, TX, 3Division of Biostatistics & Epidemiology, Cincinnati Children's Hosp. Med. Ctr., Cincinnati, OH, 4Division of Neurology, Cincinnati Children’s Hosp. Med. Ctr., Cincinnati, OH.

**Learner Objectives:**

At the end of the session, participants will be able to discuss the cognitive function of cochlear implant users in different domains.
At the end of the session, participants will be able to explain the value of BrainCheck online platform as a convenient and effective way to self-evaluate cognitive function.
Abstract Content:

Introduction: Previous research has shown the positive effects of cochlear implantation in children with a short duration of single sided deafness (SSD). This study aims to assess the impact of cochlear implantation on a cohort of children with a longer average duration of SSD.

Methods: A retrospective chart review of 9 children who received a cochlear implant for SSD. Pre- and post-operative audiometric data for aided speech perception testing, sentence recognition in quiet, sentence recognition in noise, word recognition scores, and processor wear time were analyzed.

Results: The mean age of deafness was 12.3 years old (median: 15, Interquartile range (IQR): 10,16) and mean duration of hearing loss before cochlear implantation was 7.78 years (median 7, IQR: 2,13). When compared to preoperative hearing aid scores, a 48% significant increase in median sentence recognition score in quiet (IQR 25, 64) and a 26% significant increase in median word score (IQR:12,42) was observed at 12 months post op.

Conclusion: Cochlear implantation in children with a longer duration of SSD can provide benefit to speech recognition.

Primary Author/Presenter: Samantha Morgan


Learner Objectives:

Describe the speech recognition outcomes of older children with single sided deafness receiving cochlear implants

Contrast the post-implant speech recognition scores of children with single sided deafness to pre-implant unaided and CROS aided scores.
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: Audiology
Poster Exhibit Number: 3 Student Poster Competition?

Abstract Number: 42

Poster/Abstract Title: The effect of intracochlear electrode design on electrically evoked compound action potential growth and spread of excitation functions

Abstract Content:

Introduction: The design of cochlear implant (CI) electrodes has changed over the years. Perimodiolar electrode, a traditional design with electrode contacts positioned closer to the modiolus, has been transformed to be slimmer and softer. Lateral wall straight electrode, a relatively newer design with electrode contacts seated further from the modiolus, has been used recently with an increasing interest in less traumatic surgery and preserving residual acoustic hearing. Changes in intracochlear electrode design might influence the spread of neural activation along the auditory nerve and the number of independent channels of information that can be used for speech recognition. This study aimed to objectively characterize the influence of the intracochlear electrode design on neural excitation of the peripheral auditory system.

Methods: Twenty-three adults who were implanted with Nucleus CI participated in this study. Thirteen subjects were implanted with lateral wall straight electrode (i.e., Nucleus CI522, 622), while ten were implanted with perimodiolar electrode (i.e., Nucleus CI532, 632). Electrically-evoked compound action potential (ECAP) was recorded via neural response telemetry from three different electrodes (i.e., E6, 11, 17) across varied stimulation levels. A growth function was generated to measure ECAP threshold and slope. The spread of excitation (SOE) function was obtained by varying the masker electrodes. Peak width at a half amplitude of SOE function was measured to quantify channel interaction. Thresholds, slopes of ECAP growth function, SOE widths, and electrode impedance were compared between groups.

Results: Slopes of ECAP growth function were significantly lower in CI users with perimodiolar electrode compared to those with lateral wall slim electrode (F = 4.925, p = .038), while ECAP thresholds were comparably similar between the two groups (F<sub>sub</sub> = 48.391, p = .455). Peak widths of SOE function were significantly larger in CI users with lateral wall straight electrode, indicating a wider spread of excitation compared to those with perimodiolar electrode (F = 48.391, p < .001). Electrode impedance was significantly lower in the perimodiolar electrode group (F = 9.355, p = .006).

Conclusion: Results suggest that the difference in the intracochlear electrode design had an impact on neural excitation patterns at the peripheral level. Perimodiolar electrode exhibited shallower ECAP slopes and smaller SOE widths than lateral wall straight electrode. This indicates that the electrode array that hugged the modiolus had less overlap in neural excitation between adjacent electrodes, which results in reduced channel interaction than the electrode array positioned more laterally. These findings may expand our understanding of the response of the auditory nerve per the design of the electrode array and provide evidence to help inform decisions about which electrode array to select for prospective CI recipients.

Primary Author/Presenter: Jeong-Seo Kim

Author Block: Jeong-Seo Kim, AuD, PhD1, Il Joon Moon, MD, Ph.D.2;1Hearing Research Laboratory, Samsung Med. Ctr., Seoul, Korea, Republic of, 2Department of Otolaryngology-Head and Neck Surgery, Sch. of Med., Sungkyunkwan Univ., Seoul, Korea, Republic of.

Learner Objectives:
CI2023 Dallas: Cochlear Implants in Children and Adults

At the end of this session, participants will be able to discuss the influence of the design of the intracochlear electrode on neural response patterns by comparing ECAP thresholds and slopes of the growth function between perimodiolar and lateral wall st

Participants will be able to describe the influence of the design of the intracochlear electrode on channel interaction by comparing peak widths of ECAP spread of excitation function between perimodiolar and lateral wall slim electrodes.
Introduction: Cochlear implants (CI) are reliable implantable devices that are highly cost-effective in reducing the burden of hearing loss at an individual and societal scale. However, only 10% of CI candidates are aware of their candidacy and receive a CI. A web-based screening tool to assess CI candidacy may make many more individuals aware of their candidacy for cochlear implantation. The objective of this study was to validate and optimize our institution’s CI candidacy calculator against gold-standard, in-clinic audimetric testing.

Methods: A retrospective chart review of patients who underwent initial CI consultation at our institution’s Cochlear Implant Center in 2020 was conducted. The CI candidacy calculator assesses CI eligibility for each ear independently using word discrimination scores and high-frequency pure-tone average (PTA) at 1000, 2000, and 4000 Hz as its diagnostic criteria. Audiogram data (at 250, 500, 1000, 2000, 4000, 6000, and 8000 Hz) and word discrimination scores were inputed into the CI candidacy calculator. Receiver operating characteristic (ROC) and area under the curve (AUC) analyses were performed to identify optimal diagnostic thresholds. Calculator results using diagnostic thresholds defined by ROC-AUC analyses were compared against the formal clinical diagnosis provided by the audiologist at the time of visit. Absolute accuracy, sensitivity, specificity, and ROC-AUC score were calculated.

Results: Of the resulting 132 patients, 63 were male, and the mean age was 65.7 years. Single-sided deafness (SSD) was present in 54 patients, and 114 were clinically determined to be CI candidates (including 54/54 patients with SSD and 60/78 of all other patients). ROC-AUC analyses identified optimal diagnostic thresholds of high-frequency PTA ≥ 65 dB and word discrimination score ≤ 50%. To maximize sensitivity at the expense of specificity, diagnostic thresholds of high-frequency PTA ≥ 65 dB and word discrimination score ≤ 70% were chosen, which yielded an absolute accuracy, sensitivity, specificity, and ROC-AUC score of 0.90, 0.94, 0.82, and 0.88, respectively.

Conclusion: A novel online CI candidacy calculator exhibits high sensitivity and accuracy, and moderate specificity. The calculator may thereby be useful in increasing awareness of potential CI candidacy, increasing prevalence of CIs, and decreasing the burden of hearing loss.

Primary Author/Presenter: Raymond So

Author Block: Raymond J. So, AB, Dominic Padova, MS, Stephen Bowditch, AuD, Yuri Agrawal, MD MPH; Department of Otolaryngology - Head and Neck Surgery, Johns Hopkins Sch. of Med., Baltimore, MD.

Learner Objectives:

At the end of the session, participants will be able to explain how routine office-based audiometry may be used to predict the results of a formal cochlear implant candidacy evaluation.

At the end of the session, participants will be able to discuss one way to improve awareness of potential cochlear implant candidacy.
Abstract Content:

Introduction: The COVID-19 pandemic has revealed the need for increased accessibility and availability of remote services. Traditionally, patients are seen at their closest cochlear implant centre. However, in Ontario, Canada, there are only three adult centres to service the whole province. This means that at Sunnybrook Health Sciences Centre, we will see patients from great distances such as Thunder Bay (343 km/one way), Sault Ste. Marie (685 km), and North Bay (1,379 km). Some of these patients have great difficulty accessing care for multiple reasons. These may include poor weather conditions, needing to take time off work, COVID concerns, mobility issues, fear of coming into the hospital, lack of transportation/funds, or poor health, to name a few. These barriers can be potentially overcome by remote programming options.

Methods: We hope to overcome the barrier of distance by programming the patient’s cochlear implant in their own home virtually. We will make adjustments to the cochlear implant processor via internet over video connection between the audiologist and the patient. It is a live appointment with the audiologist present from their office and running the appointment. The audiologist controls the software remotely while the patient is at home. The patient will need to have access to the cochlear implant software, which will be shipped to them on a password-protected laptop. This service would be offered to patients who have already completed one year of in-person appointments, which is their standard of care. We will make adjustments to the cochlear implant processor via internet over video connection between the audiologist and the patient. It is a live appointment with the audiologist present from their office and running the appointment. The audiologist controls the software remotely while the patient is at home. The patient will need to have access to the cochlear implant software, which will be shipped to them on a password-protected laptop. This service would be offered to patients who have already completed one year of in-person appointments, which is their standard of care.

Results: • At this time, only 5 participants have completed the study so far. Recruitment is on-going. • Preliminary data shows 40% of participants preferred their in-person MAP, 40% preferred remote programming MAP, and 10% had no preference. • 100% of patients were satisfied with their remote programming appointments • 100% of patients would recommend remote programming to a friend and would use the service again. • The majority of patients were either fairly or very confident that they could do remote programming again.

Conclusion: Based on the data so far, all participants have indicated satisfaction on their remote programming experiences. Preliminary data suggests that remote programming is a feasible method for adjusting cochlear implant speech processors. As more data is accrued, we will look at the sustainability and the impact of other models of remote programming.

Primary Author/Presenter: Jessica Banh

Author Block: Jessica Banh, M.Sc.1, Amy Ng, M.Sc.1, Laura Shaw, B.Sc1, Yasmeen Aboulhawa, M.Sc.1, Vincent Lin, MD FRCSC2, Trung Le, MD FRCSC2, Joseph Chen, MD FRCSC2; 1Cochlear Implant Program, Sunnybrook Hlth. Sci. Ctr., Toronto, Canada, 2Otolaryngology, Sunnybrook Hlth. Sci. Ctr., Toronto, Canada.

Learner Objectives:

Describe the feasibility of remote programming of cochlear implant speech processor as a clinical procedure.

Comparing the effectiveness of programming cochlear implants remotely versus in-office (current standard of care).
**Poster Category:** Audiology

**Poster Exhibit Number:** 6  
**Student Poster Competition?**

**Abstract Number:** 59

**Poster/Abstract Title:** Management of a Cochlear Implant User with Fluctuating Middle Ear Pressure Changes: A Case Study

**Abstract Content:**

Introduction: The review of current literature demonstrates not much is empirically known about the effects of middle ear status on a cochlear implant. Intuitively, one may think middle ear status would not affect cochlear implant performance, however, anecdotal evidence suggests changes can be seen in both subjective report of hearing for patients with active middle ear dysfunction (Dixon et al., 2014 and Vargus et al., 2012). Other case studies have also demonstrated an effect of middle ear dysfunction and inflammation on cochlear implant impedance (Neuberger et al., 2009; Vargus et al., 2012). This case describes a 58-year-old male unilateral cochlear implant recipient that experienced recurrent fluctuations in middle ear pressure and subsequent changes in measured electrical dynamic range and subjective speech understanding. In this case, the patient experienced regular changes in middle ear pressure and changes which resulted in changes in the measured electrical dynamic range, subjective listening effort, and speech perception scores. The audiologist made a plan to create maps specifically for use in the presence of normal middle ear function and in instances of significant negative middle ear pressure. The patient was then given the ability to change between these maps manually as he experienced sinus/otic pressure symptoms and subjective changes in speech understanding. Widening of the electrical dynamic range for a single electrode when the patient had negative middle ear pressure prompted the audiologist to deactivate the affected electrode for his abnormal middle ear pressure map. Ultimately, the physician determined placement of pressure-equalization tube was the most appropriate treatment.

**Methods:** This was a retrospective case analysis. Data collection for this case included the following audiometric tests: tympanometry, impedance measures, measurement of T and C levels, aided threshold testing, and aided speech perception testing (CNC words and AzBio sentences). Results: Differences were noted in measured T-levels for an electrode in the middle of array when the patient experienced changes in middle ear pressure, quantified with tympanometry. Data collection is still ongoing; measurements outlined in the methods will be repeated post-PE tube placement in late 10/2022 and 12/2022. Preliminary data shows AzBio scores in quiet increasing from 72% correct to 95% and CNC word scores increasing from 20% to 76% following PE tube placement and remapping.

Conclusion: Our case illustrates the challenge that fluctuating middle ear pressure/middle ear dysfunction poses to cochlear implant performance. Changes in the patient’s measured electrical dynamic range were seen consistently with changes in middle ear pressure. The audiologist provided different maps/programs for the patient to use when changes in pressure occurred and ultimately the surgeon made the decision to place a PE tube in the implanted ear to stabilize pressure.

**Primary Author/Presenter:** Jordan Alyse Coffelt

**Author Block:** Jordan Alyse Coffelt, AuD1, Sarah E. Warren, AuD, PhD, MPH1, Robert J. Yawn, MD, MBA2;1School of Communication Sciences and Disorders, Univ. of Memphis, Memphis, TN, 2Department of Otolaryngology-Head and Neck Surgery, Univ. of Tennessee Hlth. Sci. Ctr., Memphis, TN.

**Learner Objectives:**
Describe how changes in middle ear pressure can affect a patient’s measured electrical dynamic range.

Contrast patient speech perception performance pre- and post-pressure equalization tube placement.
Abstract Content:

Introduction: In individuals with single sided deafness (SSD), which are characterised by a profound hearing loss in one ear and normal hearing in the contralateral ear, binaural input is no longer present. A cochlear implant (CI) is the only way to restore functional hearing in the profoundly deaf ear, with previous literature demonstrating improvements in speech in noise intelligibility with the provision of a CI. However, we currently have a limited understanding of the neural processes involved (e.g., how the brain integrates the electrical signal produced by the CI with the acoustic signal produced by the normal hearing ear) and how the modulation of these processes with CI contributes to improved speech in noise intelligibility. Using a semantic oddball paradigm presented in the presence of background noise, this study aims to investigate how the provision of CI impacts speech in noise perception of SSD CI users.

Methods: Task performance (reaction time, reaction time variability, target accuracy, subjective listening effort) and high density electroencephalography from twelve SSD-CI participants were recorded whilst they completed a semantic acoustic oddball task. Reaction time was defined as the time taken for a participant to press the response button from stimulus onset. All participants completed the oddball task in three different free field conditions with the speech and noise coming from different speakers. The three tasks were 1) with the CI-On in background noise, 2) with the CI-Off in background noise and 3) with the CI-On without background noise (Control). Task performance and electroencephalography data (N2N4 and P3b) were recorded for each condition. Speech in noise and sound localisation abilities was also measured.

Results: Reaction time was significantly different between all tasks with CI-On (M(SE) = 809(39.9) ms) having faster RTs than CI-Off (M(SE) = 845(39.9) ms) and Control (M(SE) = 785(39.9) ms) being the fastest condition. The Control condition exhibited a significantly shorter N2N4 and P3b area latency when compared to the other two conditions. However, despite these differences noticed in RTs and area latency, we observed similar results between all three conditions for N2N4 and P3b difference area.

Conclusion: The inconsistency between the behavioural and neural results suggest that EEG may not be a reliable measure of cognitive effort. This rationale is further supported by the different explanations used in past studies to explain N2N4 and P3b effects. Future studies should look to alternative measures of auditory processing (e.g., pupillometry) to get a deeper understanding of the underlying auditory processes that facilitate speech in noise intelligibility.

Primary Author/Presenter: Marcus Voola

Author Block: Marcus W. R. Voola, Master of Clinical Audiology1, Andre Wedekind, PhD2, An T. Nguyen, PhD2, Welber Marinovic, PhD2, Gunesh Rajan, PhD2, Dayse Tavora-Vieira, PhD2;1Audiology, Fiona Stanley Hosp., Winthrop, Australia, 2Audiology, Fiona Stanley Hosp., Murdoch, Australia.

Learner Objectives:
CI2023 Dallas: Cochlear Implants in Children and Adults

Identify the differences in N2N4 and P3b amplitude and latency when recorded from a cochlear implant and a normal hearing ear.

Discuss the use case of High Density EEG as a measure of cognitive effort in cochlear implant users.
**Abstract Content:**

Introduction: With the rise in life expectancy and the consequent increase in the elderly population, the use of cochlear implants (CI) in elderly patients with hearing loss is also increasing. The aim of this study was to investigate whether music appreciation in elderly CI users differs from that of non-elderly users.

Methods: Forty-nine adult CI recipients participated in the study, and the Korean version of the Music Background Questionnaire was utilized preoperatively and postoperatively to evaluate music appreciation. The changes between the preoperative and postoperative values were compared after categorizing the participants into a non-elderly group (<65 years; n = 31) and an elderly group (≥65 years; n = 18).

Results: When compared to the non-elderly group, the elderly individuals exhibited a significant decrease in music listening times, without a significant change in the genre of music listened to following CI surgery. Moreover, the elderly group demonstrated significant decreases in music appreciation scores in terms of music quality and music elements, perceiving music as less natural, less clear, and more complex. They also exhibited significant changes in scores with respect to perception of rhythm, melody, timbre, and lyrics.

Conclusion: This susceptibility to postoperative changes in music appreciation among elderly CI users should be considered in surgical counseling and music training programs.

**Primary Author/Presenter:** Jin Woong Choi

**Author Block:** Jin Woong Choi, MD, PhD, Chungnam Natl. Univ. Coll. of Med., Daejeon, Korea, Republic of.

**Learner Objectives:**

At the end of the session, participants will be able to differentiate music appreciation between non-elderly and elderly CI recipients.
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: Audiology
Poster Exhibit Number: 9  Student Poster Competition?

Abstract Number: 75
Poster/Abstract Title: Evaluating the need for routine follow up visits in the cochlear implant clinic via remote performance monitoring.

Abstract Content:

Introduction:
Cochlear implant (CI) follow up appointments are important to recipient outcomes. This is particularly important during the first year following activation of the CI device. Our traditional follow up schedule has patients returning to the clinic 6-7 times in the first year following activation, twice the second year and annually thereafter. The decrease in return visits occurs because patient performance and changes in psychophysical measurements plateau. Annual appointments consist of patient report regarding performance and potential concerns, audiological testing including threshold detection and speech perception testing to monitor performance, internal device monitoring and programming adjustments as needed. Patients who report stable hearing and demonstrate consistent scores on performance measures often have minimal or no programming changes during these visits. Annual trips to the clinic can be a burden for patients, particularly due to distance, time required for the travel, finances and the need for assistance from family or friends. Use of mobile applications to conduct remote, self-administered testing could negate the need for an annual visit when cochlear implant benefit and test outcomes are determined to be stable. The primary objective of this study is to determine whether the results from remote, self-administered performance measures can be used by clinicians to determine the need for annual in-person cochlear implant follow up visits.

Method:
Fifteen (15) adult cochlear implant recipients will be drawn from the adult clinical population during routine clinical care. Subjects will have at least 12 months cochlear implant experience and clinician knowledge of good audibility. Subjects must use a specific, Bluetooth capable sound processor, have experience with an iOS-compatible device and can understand, read and respond in English print. Subjects will complete a self-administered, remote monitoring session consisting of speech perception and tone detection tasks and subjective feedback questionnaires administered via a mobile application within 2 weeks prior to their routine, follow-up clinic visit. Results from the remote monitoring session will be reviewed by a clinical audiologist who will provide a rating determining need for the routine follow up visit. All patients will then complete the scheduled follow up visit. Following this visit, both the subject and audiologist who conducted the routine clinical visit will complete questionnaires to assess attitudes toward remote monitoring and utility of incorporation of the remote assessments into clinical practice. Results will be in positive agreement following review of the remote monitoring session results and the clinical follow up appointment results.

Conclusions:
Favorable performance test results and subjective ratings of benefit and hearing performance as measured using a remote monitoring mobile application can provide sufficient evidence for a hearing care professional to determine when a recipient can defer a routine follow-up appointment or when intervention is required via an on-site follow-up visit.

Primary Author/Presenter: Dawn Marsiglia
Learner Objectives:

describe the self administered, remote monitoring protocol used in this study.

explain the outcome of patient remote monitoring protocol resulting in a required visit or a deferred visit.
**Abstract Content:**

Introduction: Historically, advanced sound-cleaning features have not been routinely activated in the pediatric population due to concerns of limiting access to sound. Recent evidence from studies involving children with hearing aids have suggested that the application of automatic noise management aimed at improving listening in noise could benefit school-aged children. Specifically, the application of classifier-based noise management technology could benefit pediatric cochlear implant (CI) users; however, currently there is limited evidence available regarding the use of this technology in children with CIs. The main objective of this study is to examine the effect of a classifier-based noise management algorithm on speech perception in noise in children who use CIs and to compare the speech perception outcomes of pediatric CI recipients with their age-matched, typically-hearing peers.

Methods: Ten children (age 8-15 years) with bilateral CIs and ten age-matched, typically-hearing children were recruited for this study. Speech perception outcomes were measured using the AZBio Sentences in Noise test via a clinically-feasible testing method to compare performance in the omnidirectional listening mode and classifier-based automatic noise management mode for pediatric CI users. Ratings of listening ease and clarity were also recorded to obtain subjective measures of benefit. Speech perception outcomes and subjective measures were compared to a group of typically-hearing children to evaluate whether speech-in-noise performance is significantly different with and without the application of advanced noise management, and whether the application of advanced noise management improves listening ease.

Results: The application of classifier-based noise management algorithm improved speech perception in noise in all listening conditions. Group averages revealed a 22% improvement in speech perception when using the classifier-based noise management algorithm when compared with the omnidirectional program in the 0 dB SNR condition listening. Additionally, although children with CIs demonstrate poorer speech-in-noise performance when compared to their typically-hearing peers, the provision of advanced noise management improves speech perception overall and performance approaches levels achieved by the typically-hearing children. Lastly, both listening ease and clarity are improved for speech-in-noise tasks when using the classifier-based noise management algorithm.

Conclusion: Evaluating the effectiveness of a classifier-based noise management algorithm in the pediatric population will provide evidence as to whether advanced noise management features should be activated in this population. Given the difficult listening environments children face, especially in the typical classroom setting while listening for learning, provision of advanced noise management technology may benefit children using CIs to improve understanding in adverse listening situations and improve listening ease.

**Primary Author/Presenter:** Ursula Findlen

**Author Block:** Ursula Findlen, PhD1, Smita Agrawal, PhD2;1Clinical Therapies- Audiology Department, Nationwide Children's Hosp., Columbus, OH, 2Advanced Bionics, LLC, Valencia, CA.

**Learner Objectives:**
CI2023 Dallas: Cochlear Implants in Children and Adults

Examine speech perception outcomes in noise of bilateral CI users as compared to their typically-hearing peers.

Describe a clinically-feasible method for evaluating both objective and subjective benefit from advanced noise management technology in the pediatric population.
Abstract Content:

Introduction: Recently, patients with certain legacy cochlear implants (CIs) have sought reimplantation to enjoy the benefits of newer processor technology, including the ability to stream to an electronic device, be exposed to water, afford greater battery life, and offer potential improvements in speech understanding in noise. This decision can, however, be difficult, particularly when the individual relies exclusively on the original device for communication and is scoring at the ceiling of performance metrics. To date, most outcome data are derived from reimplanting a non-functioning CI—a relatively easy decision. This study reports hearing outcomes following the reimplantation of legacy implants performed to improve processor technology. The intent of the study is to guide clinicians and patients in approaching this high-stakes clinical situation.

Methods: Following Institutional Review Board approval (IRB 00045048), a retrospective chart review identified three patients with Advanced Bionics Clarion C1 internal device reimplantation in whom the original device was functioning normally. All cases of reimplantation due to device failure were excluded. Demographic data and audiometric performance before and after reimplantation were recorded. Results: The three cases included two males aged 25 and 81 and a female aged 20 at the time of presentation. Each patient had received their original cochlear implant at least 20 years before the discussion of reimplantation. All three reimplanted patients showed maintenance or improvement in their audiometric performance and expressed satisfaction with expanding technological capabilities, including improved battery life and device connectivity. There were no failed reimplantations, incomplete electrode insertions, or other adverse effects. Conclusion: Reimplantation of legacy Advanced Bionics Clarion C1 devices can be accomplished with stability or improvement of speech understanding with the new device. As reimplantation continues, patients can experience improvement in their CI experience with updated processors, novel programming schemes, greater connectivity options, improved battery life, and accessories that can greatly expand access to sound. Given the present rate of technological advancement in cochlear implantation, these data will serve to support the inevitable reimplantation of current-generation devices as future devices emerge.

Primary Author/Presenter: Nicole Ewer

Author Block: Nicole Ewer, BS1, Cache Pitt, AuD2, Richard K. Gurgel, MD, MSC13, Neil S. Patel, MD3;1Univ. of Utah Sch. of Med., Salt Lake City, UT, 2Utah State Univ., Logan, UT, 3Department of Otolaryngology, Univ. of Utah, Salt Lake City, UT.

Learner Objectives:

Describe the risks and benefits that face patients considering reimplantation of functional legacy cochlear implant devices.

Discuss specific case outcomes for patients that received reimplantation of their functional legacy cochlear implant device.
Abstract Content:

Introduction: The Comprehensive Hearing Assessment Team (CHAT) Clinic was developed by our team to serve children who are considering obtaining a Cochlear Implant. Experts from otolaryngology, speech language pathology, genetics, social work, and audiology work together to assess a child’s cochlear implant candidacy. The aim of this study is to assess the parent’s experience with the CHAT clinic. Specifically, the goals of the CHAT clinic are to: Provide support, education, and guidance regarding cochlear implant technology to caregivers and patient, Assess current functional listening skills, speech, and language development, Discuss options for communication modalities and address realistic expectations regarding Listening and Spoken Language (LSL) skills post cochlear implantation, Provide information about early intervention, school, and community services, Examine possible genetic contributions to hearing loss, Assess the emotional and support system needs of patients and families.

Methods: The new CHAT clinic has been assessing 4 children per month. There were 8 clinics completed so far. A total of 27 children have been evaluated. Families have been asked to provide their satisfaction via a Patient Experience Survey which asks families to rate as Excellent, Very Good, Good, Fair or Poor for 10 items which include the following statements: • Do you believe that having a multidisciplinary team seeing your child in one setting was helpful to your FAMILY? • Do you believe that having a multidisciplinary team seeing your child in one setting was helpful for your CHILD? Results: Of the 27 families who participated in the CHAT clinic, we received 14 completed surveys at the time of the abstract submission. 93% of our families reported very good to excellent satisfaction with the multidisciplinary team setting for their family. 69% of the families reported very good to excellent satisfaction with the multidisciplinary team setting for their child.

Conclusion: The multidisciplinary approach to cochlear implant evaluation is underutilized in a pediatric setting. Lack of physical space to accommodate multiple specialties as well as conflicting discipline/professional schedules create barriers to implementation. In addition, there are concerns regarding a young child’s ability to complete lengthy testing in a single visit and family acceptance of such a long evaluation process which have not been closely examined. Based on our initial patient satisfaction data, the CHAT clinic seems to be well received by families and our patients have been able to complete all appointments. We will continue to assess patient satisfaction as well as our ability to accelerate the implant candidacy process.

Primary Author/Presenter: Keri Colio


Learner Objectives:

At the end of the session, participants will be able to discuss the benefits of a comprehensive hearing assessment team when assessing cochlear implant candidacy.
CI2023 Dallas: Cochlear Implants in Children and Adults

At the end of the session, participants will be able to describe the benefits of adding a genetic counselor to the cochlear implant team.
**Abstract Content:**

Introduction: Both hearing aids and cochlear implants help people with hearing loss to communicate better. About two-thirds of adults ≥70 years of age have hearing loss. Auditory rehabilitation can reverse the adverse affects of and dysfunction from hearing loss. Hearing aids and cochlear implants (CIs) provide improved audiolologic performance and improvements in QOL.

Methods: Twenty five cochlear implant (CI) (Case group) and twenty five Hearing aid (HA) (Control Group) patients in the age range of 18 years or older with an implant age of six to twenty four months were identified. To assess QOL, the Nijmegen Cochlear Implant Questionnaire was used. This questionnaire is composed of 6 subdomains: basic sound perception, advanced sound perception, and speech production comprise the physical domain; self-esteem is the psychological domain; activity limitations and social interactions encompass the social domain. Both CI and HA patients were separately mailed 2 copies of the questionnaire 2 weeks apart and were returned anonymously. The first version was for the pre-rehab state (ie, without the CI or HA) and the second version for the post-rehab state (i.e., with the CI or HA). Statistical analysis was performed with SigmaStat and SPSS software (SPSS Inc., Chicago, IL, USA). Repeated measure analysis of variance was used to determine if group (CI versus HA), time of evaluation (pre- versus post-intervention), or interaction between group and time were associated with QOL benefit.

Results: A total of 23 responses from CI patients and 30 responses from HA patient were obtained. On Chi-Square test, Cochlear Implantation (Post-CI) speech production score was found to be 59.2%. In the CI, the highest rated QOL subdomain score was speech production (24.29+0.71), followed by social interaction (23.74+1.03), activity limitations (23.09+1.22), basic sound perception (22.51+1.50), self-esteem (21.80+1.49), and advanced sound perception (21.94+1.83). Highest satisfaction rate area is of interconnectedness (mean=25.94), followed by communication with others (mean=24.99), family life (mean=22.62), radio (mean=16.00), music (mean=11.64), new relationship (mean=11.08), contribute to society (mean=10.87). The highest rated subdomain score for the HA group was for speech production, followed by self-esteem, activity limitations, social interaction, advanced sound perception, and basic sound perception.

Conclusion: Positive effects on QOL provided by the CI were evident where recipients reported improved family life, interconnectedness, communication, and independence. They felt more able to participate in conversations, and reported better vocational prospects, with decreased feelings of loneliness, depression, and social isolation. Comments from CI recipients also showed the high value placed on a CI, and the ability to be able to hear again; a number of CI recipients expressed that the CI was the best thing that had ever happened to them.

**Primary Author/Presenter:** Punam Kumari

**Author Block:** Punam Kumari, MASLP1, Sumit Mrig, Surgeon1, Ayash Jain, PHD2, Rajani Mathur, PHD2, Samriddhi Nijhawan, BASLP, Masters in Psychology1;1Audiology, Sankalp ENT & Cochlear Implant Ctr., New Delhi, India, 2Dept. of Pharmacology and Clinical Res., Delhi Pharmaceutical Sci. and Res. Univ., New Delhi, India.
Ci2023 Dallas: Cochlear Implants in Children and Adults

To compare the quality-of-life (QOL) benefit received from cochlear implants (CIs) and hearing aids (HAs) among hearing-impaired adults.
Abstract Content:

Introduction: Cochlear implant (CI) mapping refers to a process by which a CI audiologist programs the sound processor to provide an appropriate amount of electric current which optimizes patient performance and allows the patient to hear at a comfortable level. Children with inner ear malformations (IEM) who receive implants may present a challenge for CI audiologists based on differences in inner ear anatomy affecting current needs and the lack of significant published data informing this process. This study aims to investigate the parameters of CI mapping among children with IEMs as compared to a control population to further understand this important step in enabling the use of cochlear implants.

Methods: A retrospective cohort design was implemented examining patients who underwent cochlear implantation surgery at our academic institution. Pre-operative radiological reports written by trained neuroradiologists or neurotologists were screened for evidence of IEMs. The experimental group of 18 patients with IEMs was compared to a control population of 31 patients without IEMs after matching by age and implant type. Both groups were implanted with the same electrode array. Charge parameters along the implant array at post-operative audiology appointments up to 36 months after implantation were compared as the primary outcome. Patients programmed with different stimulation rates were not analyzed, as different rates affect threshold and comfort levels.

Results: No significant difference was found in charge parameters across the implant array between children with IEMs and children without IEMs. One year after implantation, average threshold current values were between 3-6 nanoColumb (nC) in both the IEM group and the control group and were not significantly different. Comfort current values at one year after implantation ranged from 9-12 nC in both groups and were not significantly different. Apical, middle, and basal regions of the implant were independently analyzed and did not significantly differ between the IEM group and control group.

Conclusion: Charge parameters for programming cochlear implants in children with IEMs did not differ significantly from charge parameters in a control group. Reasons for the lack of differences are being explored; electrode impedance values and specific malformation types may play a role in our cohort, as well as restricting our analyses to those programmed with the same stimulation rate.

Primary Author/Presenter: Ian Dorney

Author Block: Sarah Mowry, MD1, Ian Dorney, BS2, Viral Tejani, AuD, PhD1;1Univ. Hosp. Cleveland Med. Ctr., Cleveland, OH, 2Case Western Reserve Univ. Sch. of Med., Cleveland, OH.

Learner Objectives:

Compare the charge parameters used in implant mapping between patients with confirmed inner ear malformations to patients without inner ear malformations.
Abstract Content:

Introduction: The main indication for bilateral cochlear implants (CIs) is the range of binaural hearing, a skill that allows sound localization and better auditory perception and discrimination in noisy environments. The presence of binaural hearing can be demonstrated electrophysiologically by the binaural interaction component (BIC) and clinically by the Hearing in Noise Test (HINT). The aim of this study was to analyze the correlation between latencies and amplitudes of the BIC of the cortical auditory evoked potential (BIC-CAEP) and HINT performance in bilateral CI users

Methods: The cochlear implant group (CIG) consisted of 17 individuals with bilateral CIs, and the control group (CG) consisted of 22 volunteers with normal hearing. The latencies and amplitudes of the P1 and N1 components of the BIC-CAEP, auditory effort by a visual analog scale (VAS) and performance in the fixed and adaptive HINT were investigated. The results were compared between groups. Results: There was a statistically significant difference between the CIG and CG in terms of VAS score, performance in HINT and P1 amplitude of the BIC-CAEP. There was a moderate, negative, and significant correlation between the fixed HINT performance and the P1 amplitude of the BIC-CAEP. Conclusion: The amplitude of the BIC-CAEP P1 component was correlated with clinical performance in the fixed HINT, i.e., electrophysiological and clinical binaurality are correlated in bilateral CI users.

Primary Author/Presenter: Fernanda Ferreira Caldas

Author Block: Fernanda F. Caldas, Au, MSc, PhD1, Alice A. Takeuti, Master2, Joanlise M. Andrade, PhD3, Hugo A. S. Carvalho, Master4, Fayez Bahmad Jr, PhD1;1Univ. of Brasilia; Brasiliense Inst. of Otorhinolaryngology, Brasilia, Federal District, Brazil, 2Health Sciences Faculty, Univ. of Brasilia; Brasiliense Inst. of Otorhinolaryngology, Brasilia, Federal District, Brazil, 3Univ. of Brasilia, Brasilia, Brazil, 4Univ. of São Paulo; Brasiliense Inst. of Otorhinolaryngology, Bauru, SP; Brasilia, Federal District, Brazil.

Learner Objectives:

Identify the binaural hearing in bilateral cochlear implant users using clinical and electrophysiological methods. At the end of the session, participants will be able to understand the importance of analyze objectively the binaural hearing.
Abstract Content:

Introduction: Cochlear implantation (CI) is suspected to carry an increased risk for vestibular hypofunction. We aim to evaluate the prevalence of vestibular hypofunction in CI candidates with bilateral profound hearing loss as well as assess if CI increases the risk of vestibular weakness in these patients.

Methods: A retrospective chart review in adults aged 18 years and older from 2012 to 2022 was performed at a tertiary medical center. A videonystagmography (VNG) test with caloric evaluation was performed routinely in the CI candidate population, irrespective of symptoms. Patients subsequently underwent CI, with a single surgeon and manufacture via a cochleostomy approach.

Results: We retrospectively reviewed baseline rate of vestibular weakness in 180 patients with bilateral profound hearing loss who were determined to be cochlear implant candidates. A high rate of 39.4% vestibular hypofunction was identified. Of this percentage and prior to cochlear implantation, caloric evaluation revealed 26.8% had bilateral weakness, 60.5% had unilateral weakness ipsilateral to the scheduled implant ear and 12.7% had contralateral weakness. A subset of the population (21 patients) underwent an additional VNG prior to second side CI. Of these two patients had new vestibular weakness in the ear that was implanted. While nonsignificant due to limited sample size, our data comparing patients who had vestibular weakness after CI (n=2, 4 ears) to those who did not (n=19, 26 ears), did reveal some interesting patterns. The patients with vestibular weakness were women, with an average age of 60.5 years, compared to an average of age of 50.2 years in patients without identified vestibular weakness. The patients who had resultant new vestibular weakness had higher hearing thresholds especially in the low frequency; at 250 Hz (97.5 ± 9.6 vs. 62.3 ± 23.1), 500 Hz (98.8 ± 8.5 vs. 71 ± 20.8), 1000 Hz (97.5 ±15.5 vs. 81 ± 17.3), 2000 Hz (90 ±20 vs. 86 ± 16.5) with higher pure tone average as well (95.4 ±14.4 vs. 79.3 ±15.4).

Conclusions: CI candidates have a high prevalence of preoperative vestibular weakness both unilateral and bilateral. CI was found to increase the risk for further vestibular weakness. Taken together, CI recipients are at increased risk for clinically significant vestibular weakness. This increased risk should be considered prior to bilateral cochlear implantation especially for elderly women with worse hearing thresholds in the low tones that were found to have increased risk of vestibular hypofunction at baseline and after cochlear implantation. This increased risk for vestibular hypofunction, is important in counseling and medical decision making prior to considering a second side cochlear implantation.

Primary Author/Presenter: Hannah Dunn

Author Block: Hannah Dunn, BA1, Allison Reeder, MD2, Rema Shah, BS2, John F. Kveton, MD2, Nofrat Schwartz, MD2;1Yale Hearing and Balance Ctr., New Haven, CT, 2Yale New Haven Hosp., New Haven, CT.

Learner Objectives:

Discuss the prevalence and baseline risk for vestibular hypofunction in cochlear implant candidates
Poster Category: Audiology

Poster Exhibit Number: 17  Student Poster Competition?

Abstract Number: 116

Poster/Abstract Title: Speech recognition benefits of matching the processing speeds of a cochlear implant and contralateral hearing aid

Abstract Content:

Introduction: Cochlear implant (CI) systems and hearing aids (HA) differ in the processing speed of the information presented to the patient. The HA processes and presents the acoustic signal at a slower speed than CI systems, resulting in a device delay between the two ears (Zirn et al., 2015). Differences in the processing speed between the two devices may limit the performance on tasks of binaural hearing for bimodal patients. The purpose of this study was to compare the speech recognition in noise for post-lingually deafened adult bimodal listeners when the processing speeds were matched as compared to mismatched with the individual default settings.

Methods: Adult bimodal listeners with asymmetric hearing loss completed speech recognition in noise tasks while listening with the processing speed of the CI matched and mismatched to the contralateral HA. Participants were recipients of a MED-EL device in one ear and listened with an HA in the contralateral ear, with HA technologies varying across individuals. Participants listened with an ear-level processor on the CI-ear and a behind the ear or receiver in the canal HA on the contralateral ear. Testing was completed in a double-walled soundbooth with the listener seated 1 meter away from the center of an 11-speaker arc. The speakers were spaced equidistant on the horizontal plane, -90 to 90 degrees. Listeners faced the center speaker. For the speech recognition in noise task, listeners repeated the AzBio sentences presented in a 10-talker masker in three spatial conditions: 1) speech and masker from the front, 2) speech from the front and masker 90 degrees towards the CI, and 3) speech from the front and masker 90 degrees towards the HA. Performance was quantified as percent correct for the speech recognition task.

Results: Participants all had previous listening experience with the processing speeds mismatched (CI faster than HA). Better performance was observed with the processing speeds matched as compared to familiar settings with mismatched processing speeds.

Conclusion: Bimodal listeners may experience better performance on tasks of binaural hearing, such as speech recognition in noise, when the processing speed of the CI is adjusted to match the processing speed of the HA. Individualizing the programming of CI and HA devices may improve an individual’s performance with bimodal stimulation.

Primary Author/Presenter: Margaret Richter

Author Block: Margaret Richter, AuD, Meredith Rooth, AuD, Margaret Dillon, AuD, PhD; The Univ. of North Carolina at Chapel Hill, Chapel Hill, NC.

Learner Objectives:

Upon completion, participants will be able to analyze the influence of matching processing speeds between the CI and the contralateral HA on speech recognition in noise.
Introduction: Single-sided deafness (SSD) refers to deafness on one side, that is either congenital or acquired. As, especially pre-lingual children, have difficulties in sound localization and speech discrimination in noisy environments, early CI-fitting is an elegant option to lay a solid foundation for children and adolescents for a proper speech understanding and sound localization.

Methods: This study is a retrospective data analysis. All available audiological tests, which were conducted in post-operative settings, will be evaluated. These tests include audiograms, directional hearing tests and OIKiSa-hearing-tests. By using questionnaires, subjective post-operative outcomes will be evaluated. Here, the AQol-6D and the SSPQ questionnaire will be utilized.

The study includes all children with SSD, who were implanted between 2013 and 2020 in the University Clinic of St. Pölten in the otorhinolaryngology, head and neck department. Furthermore, each patient was provided with a postoperative AQol-6D and SSPQ questionnaire.

Results: All patients were under 19 years of age. All participants suffered from either congenital or acquired single sided deafness and all were recipients of a CI. For each patient that provided valuable data, the reason of the SSD was assessed, as well as the daily usage time, pure tone audiometric assessment (PTA4), OIKiSa-tests in CI-aided and unaided situations, sound localization as well in CI aided and unaided situations, the mean age of implantation and benefits in terms of sound localization and hearing in noisy environments and the age if implantation and its impact on audiological results such as PTA4, OIKiSa-results and sound localization ability. The mean PTA4 value for n=12 patients was 35.15 dB (SD ± 6.97 dB), which amounts to an average improvement of 54.85 dB. The mean improvement in SNR was 1.89 dB (SD ± 1.39). In sound localization, the mean improvement from CI-unaided compared to CI-aided tests resulted in 26.74% (SD ± 23.98%) less mistakes or a decrease in deviation in degree by 19.51° (SD ± 14.65°). The mean utility score reached by n=5 recipients that answered the AQol-6D was 0.8438 (SD ± 0.07). For n=4 the mean SSQP results amounted to 6.55 (SD ± 2.11) points. The mean daily CI-usage was 12.5h/day (SD ± 2.16h/day).

Conclusion: The audiological results documented in St. Pölten, over the last nine years, support the claim of an improved QoL of CI-recipients. Objectifiable data of this retrospective data analysis, such as pure-tone audiograms, DHT-results and OIKiSa-results, also point towards a significant improvement in hearing. This improvement supports the claim, that CI-recipients have an increased ability to interact with their environment more safely and vividly.
Introduction: The objective of this study is to evaluate speech understanding and real-world outcomes in children who use a cochlear implant (CI) in one ear and a hearing aid (HA) in the other ear as a function of fitting formula type and/or prescription targets. Participants are experienced users of DSLv5.

Methods: In phase 1 of the study, five subjects (ages 5 to 8 years, 2 males, 3 females) with previous experience with the DSLv5 participated. Three test conditions were assessed based on combinations of fitting formulas (i.e., a proprietary Bimodal Fitting Formula (BFF), a traditional pediatric fitting formula-DSLv5) and prescriptive targets with a previous generation, dedicated HA for bimodal listeners. A fourth test condition was with a traditional HA fit with DSLv5. Speech perception was measured in quiet and noise. Phase two of the study will investigate if and how BFF could be considered with an updated bimodal system (sound processor and HA) for pediatric bimodal patients who are experienced users of DSLv5. Four HA conditions will be investigated based on combinations of fitting formula and/or prescriptive targets. 1) BFF - default settings; 2) BFF - default settings with updated gains; 3) BFF fit to DSLv5 prescriptive targets; 4) DSLv5 fit to DSLv5 targets. All HA settings will be programmed and verified using measured RECDs. Speech perception scores will be obtained in a soundbooth in noise in HA alone and bimodal listening configurations. Speech testing with each test condition will be preceded by one week of real-world experience. A parent-teacher questionnaire for each fitting condition will be obtained.

Results: Phase 1: While results were variable, outcomes with BFF at default settings tended to be poorer, and no subjects preferred BFF at default settings. Outcomes with the previous generation dedicated HA with ‘BFF fit to DSLv5 prescriptive targets’ did not differ from a traditional hearing aid fit to DSL. Phase 2: Results will be reported at the conference. Conclusion: Phase 1 findings suggest that BFF fit to default settings on the previous generation dedicated HA is not appropriate for bimodal children, particularly those experienced with DSLv5. A mixture of BFF and DSL may be a good alternative to optimize audibility and align loudness growth and compression characteristics across ears. Outcomes need to be reassessed with updated technology.

Primary Author/Presenter: Julia Reid


Learner Objectives:

Describe programming considerations for children who use a cochlear implant on one ear and a hearing aid on the other.
Anomaly Pattern of Trans-Impedance Matrix in Cochlear Implant

Pizzol Erica1,2*, Ghiselli Sara1, Cuda Domenico1

1 ENT Department Guglielmo da Saliceto Hospital Piacenza, Italy

Introduction

Trans-impedance matrix (TIM) measurement is described in the literature as a methodology for assessing the correct placement of the electrodes during cochlear implant (CI) surgery. TIM was also used in routine post-surgical follow ups. In fact, these measures is useful to analyse the positioning of the CI electrodes or allows discriminating different type of etiologies in patients with CI. For these reasons it’s important a visual inspection of the TIM heatmaps or the line graph map during the follow ups. In our clinical practice, post-operative TIMs have been analyzed and was found a particular pattern called ‘Scater’. In this study we want to analyze the group of this ‘Scater’ Trans-Impedance Matrix (TIM) and we want to evaluate the correlation with different patient and device characteristics.

Methods

TIMs were observed in 697 CI. We have been excluded inner ear malformations so, the sample observed was 679 Trans-Impedance Matrix. It was found an anomaly heatmap and line graph in 66 devices (9,7%). The anomaly TIMs were divided in two groups based on gravity of alteration of visual inspection: Scatter Severe (25 devices) and Scatter Mid (41 devices). We compared Scatter Severe and Scatter Mid TIMs among them and with a group of Normal TIM. We considered: visual severity of the pattern; time of CI use; type of the internal part; auditory performance (speech audiometry at 65dB, OLSA test); impedance and NRT. We also analyzed three parameters: Shannon Entropy, the Exponential Decay constant and Spatial Correlation.

Results

A difference was found in some parameters between Scatter Severe, Scatter Mid and Normal TIM groups. The Shannon Entropy and Exponential Decay parameters have higher value in Severe scatter compared to Mid Scatter or Normal TIM. There’s also a significant results between Spatial Correlation and the three TIM groups. We do not found a significant correlation between TIM type and auditory performance, time of use and etiology. We observed only a trend in Olsa test. Scatter TIM is present also in patients with an average time of CI use of 135 months and with some type of CI internal part (Slim Modiolar and Contour Advance Electrode).

Conclusions

Scatter TIM is not correlate with auditory performance of the CI patients. It is necessary to monitor the TIM pattern and evaluate the auditory outcomes of these subjects over time for better understood the alteration of the Shannon Entropy, Exponential Decay and Spatial Correlation parameters.

Primary Author/Presenter: Erica Pizzol

Author Block: Erica Pizzol, Physical Doctor, Sara Ghiselli, Medical Doctor, Domenico Cuda, Medical Doctor; Otolaryngology, Guglielmo da Saliceto Hosp., Piacenza, Italy.

Learner Objectives:

To analyze the group of ‘Scatter’ Trans-Impedance Matrix (TIM).

To evaluate the correlation with different patient and device characteristics.
Poster Category: Audiology

Poster Exhibit Number: 21  Student Poster Competition?

Abstract Number: 143

Poster/Abstract Title: Performance with a new bone conduction implant audio processor in patients with single-sided deafness

Abstract Content:

Introduction: The SAMBA 2 BB audio processor for the BONEBRIDGE bone conduction implant features a new automatic listening environment detection to focus on target speech and to reduce interfering speech and background noises. The aim of this study was to evaluate the audiological benefit of the SAMBA 2 BB (AP2) and to compare it with its predecessor SAMBA BB (AP1).

Methods: Prospective within-subject comparison study. We compared the aided sound field hearing thresholds, speech understanding in quiet (Freiburg monosyllables), and speech understanding in noise (Oldenburg sentence test) with the AP1 and AP2. Each audio processor was worn for 2 weeks before assessment and seven users with single sided sensorineural deafness (SSD) participated in the study. For speech understanding in noise, two complex noise scenarios with multiple noise sources including single talker interfering speech were used. The first scenario included speech presented from the front ($S_{0}N_{MIX}$), while in the second scenario speech was presented from the side of the implanted ear ($S_{IPSI}N_{MIX}$). In addition, subjective evaluation using the SSQ12, APSQ, and the BBSS questionnaires was performed.

Results: We found improved speech understanding in quiet with the AP2 compared to the AP1 aided condition (on average +17%, $p=.007$). In both noise scenarios, the AP2 lead to improved speech reception thresholds by 1.2 dB ($S_{0}N_{MIX}$, $p = 0.032$) and 2.1 dB ($S_{IPSI}N_{MIX}$, $p = 0.048$) compared to the AP1. The questionnaires revealed no statistically significant differences, except an improved APSQ usability score with the AP2.

Conclusion: Clinicians can expect that patients with SSD will benefit from the SAMBA 2 BB by improved speech understanding in both quiet and in complex noise scenarios, when compared to the older SAMBA BB.

Primary Author/Presenter: Wilhelm Wimmer

Author Block: Wilhelm Wimmer, PhD1, Alexander Huber, Prof.2, Marco Caversaccio, Prof.1, Martin Kompis, Prof.1;1Department of ORL, Head and Neck Surgery, Bern Univ. Hosp., Bern, Switzerland, 2Department of ORL, Head and Neck Surgery, Univ. Hosp. Zurich, Zürich, Switzerland.

Learner Objectives:

Evaluate the audiological performance and subjective satisfaction with a new audio processor in SSD patients with a bone conduction implant.
Abstract Content:

Introduction: The consonant-nucleus-consonant (CNC) words test was developed in 1962, and to this day remains arguably the most consistently used test for measuring and monitoring the speech perception ability of adults with cochlear implants. Despite its common usage in cochlear implant centers across the country, the test itself does not report on where an individual patient’s strengths and weaknesses are in terms of their ability to hear. Knowing which frequencies are being misperceived would be useful for audiologists to know in order to target map manipulations that can help improve speech perception. In order to fill this gap, a new test called the “Strategic CNC Words” was developed by audiology staff at the hospital.

Methods: The Strategic CNC words are composed of the same consonant-nucleus-consonant morphology as the original CNC words but are also further classified into two categories: low frequency words and high frequency words. Low frequency words (eg. moon, ball) are comprised of voiced phonemes such as nasals, voiced stops and blends. Low frequency vowels are defined as having a second formant below 1500 Hz. High frequency words (eg. face, peach) are comprised of voiceless phonemes such as voiceless stops, fricatives, and blends. High frequency vowels are defined as having a second formant above 1500 Hz. Low frequency words are recorded by a male voice preceded by a carrier phrase “say the word” while high frequency words are similarly recorded by a female voice preceded by the same carrier phrase. The test is built into an app, which helps automatically calculate the patient’s score on the test. A trial of the 5 lists of the Strategic CNC Words was completed in a clinical setting. Various cochlear implants patients returning for follow up were tested in an office setting, and the results show some interesting patterns.

Results: Subjects tested so far consistently performed worse on low frequency phonemes compared to their high frequency counterparts, particularly vowels. It is posited that this may be a result of misperceiving frequencies encoded in the apical region of the cochlea. In one particular patient that was tested ten years post-activation with the Strategic CNC Words list, exploratory mapping was completed based on his individual results. Frequency allocations were modified accordingly for the apical channels, and significant acute improvement was observed.

Conclusion: Preliminary results suggest the tradition of using psychoacoustic loudness-based mapping may not necessarily be sufficient in optimizing outcomes for cochlear implant patients. The data obtained thus far appears to support the idea that a frequency allocation-based approach may improve outcomes in patients.

Primary Author/Presenter: Ricky Chow

Author Block: Ricky Chow, M.Cl.Sc.1, Amy Han Chi Ng, M.Sc.2, Trung Le, MD3, Vincent Lin, MD3, Joseph Chen, MD3;1Audiology Services, Sunnybrook Hlth. Sci. Ctr., Toronto, Canada, 2Cochlear Implant Program, Sunnybrook Hlth. Sci. Ctr., Toronto, Canada, 3Otolaryngology, Sunnybrook Hlth. Sci. Ctr., Toronto, Canada.

Learner Objectives:

At the end of the session, participants will be able to discuss the perceptual difference between high and low pitched words, and which type is more difficult for a cochlear implant user to recognize.
**Abstract Content:**

Introduction: Mapping of a cochlear implant (CI) includes defining the electric dynamic range for each active channel. Identifying the maximum comfortable loudness (MCL) for each channel can be completed with behavioral or objective measures. The behavioral measure involves the patient ranking the perceived loudness of electric simulation from threshold to MCL. The electrically evoked stapedius reflex threshold (eSRT) is an objective measure that can be used to determine the MCL level for individual channels. While there is evidence of MCL levels determined with eSRT being highly correlated with MCL levels determined behaviorally, there are cases when these methods yield different results. This discrepancy is of particular interest for CI users with normal to near-normal hearing in the contralateral ear, known as asymmetric hearing loss (AHL). For CI users with AHL, it may be important to establish a balance in loudness between the ears to achieve a maximum binaural hearing benefit. The present study aimed to characterize the relationship between eSRT and behaviorally-measured MCL levels among adult CI users with AHL and assess the differences in monaural and binaural hearing between maps.

Methods: The map settings (i.e., MCL levels) were compared for adult CI users with AHL when assigned with an objective method (i.e., eSRT) versus with a behavioral method. For the behavioral method, recipients ranked the perceived loudness of simulation, which was increased until reported as “loud but comfortable.” For the objective method, the tympanometry probe was placed in either the ipsilateral or contralateral ear and a probe tone of either 226Hz, 678Hz, or 1000 Hz was used. The simulation level on individual channels was gradually increased until the eSRT was observed. Performance with each map was evaluated with CNC words in the CI-alone condition and with AzBio sentences in the best-aided condition (CI plus contralateral ear). For the best-aided condition, the target was presented from the front and the masker (10-talker babble) was either co-located with the target, or presented 90 degrees towards the CI-ear or contralateral ear.

Results: The behavioral measurement of MCL values were in varying agreement with objectively measured eSRT values, with the majority either in agreement with the eSRT values or the behavioral values as higher than the eSRT values. Preliminary data suggest for those with a difference in the assigned MCL values, better CNC scores were observed with the behavioral map and better best-aided scores were obtained with the eSRT map.

Conclusion: The individualized mapping of MCL levels may include behavioral and/or objective measures. In some cases, these methods result in different levels. There is a need to understand the optimal methods to individualize map settings to support each patient’s best outcome with a CI.
Characterize the relationship between eSRT and behaviorally-measured MCL levels among adult CI users with asymmetric hearing loss.

Assess the differences in monaural and binaural hearing when mapped behaviorally versus eSRT.
Abstract Number: 175
Poster/Abstract Title: Timing, Outcomes and Utilization of Cochlear Implantation (CI) in Children with Congenital CMV (cCMV)

Abstract Content:

Title: Timing, Outcomes and Utilization of Cochlear Implantation (CI) in Children with Congenital CMV (cCMV)

Introduction: Cytomegalovirus (CMV) is the most common infectious cause of pediatric sensorineural hearing loss (SNHL). Timing, severity and progression of hearing loss in children with cCMV is variable, and can be asymptomatic or have multi-organ disease (symptomatic). Some states are performing targeted CMV testing for children who fail the newborn hearing screening. We examined the timing and outcomes of cochlear implant (CI) recipient children with cCMV in a cochlear implant program prior to the initiation of targeted CMV testing.

Methods: Our programmatic database from March 2015 – September 2022 was queried to identify CI recipients with cCMV. Medical characteristics: symptomatic vs asymptomatic and associated comorbidities were collected. Variables and factors including parental structure, insurance status, gender and race were identified. Predictive factors including age of identification, age of implantation, mean time from identification to implantation and wear time were collected. Clinical outcomes including aided PTA at 6 and 12 months, and age of complete Ling sound identification were recorded. Given the small sample, simple descriptive statistics were performed.

Results: During the study period 149 children (166 ears) at a free standing, tertiary care pediatric hospital underwent cochlear implantation. Of these implanted children CMV was the identified underlying etiology for four cases. Of these, three were symptomatic with developmental delays; one was asymptomatic. Two children had associated GI and ophthalmology conditions; two were premature; one was autistic. Three of four needed post operative admission. Two children had non-parental guardians; two were with biological parents. All four failed newborn hearing screening, developed severe to profound SNHL, and received bilateral cochlear implants; two sequentially and two simultaneously. The age at identification varied by parental type: biological (4 months) vs non parental guardians (25.5 months). The average age of implantation was 32 months; however mean age varied by category: symptomatic (36.7 months) vs asymptomatic (18 months), and caregiver: biological parents (18 months) vs foster parent/legal guardian (46 months). Available data revealed mean aided PTA of 35dB at 6 months and 30 dB at 12 months in symptomatic CI recipients, and 27 dB at 6 months and 22 dB at 12 months in the asymptomatic recipient. Mean time post activation until complete identification of all Ling sounds was 3 months in asymptomatic recipients vs 26 months in symptomatic recipients. Mean wear time revealed similar discrepancies with symptomatic (4 hrs at 6 month; 3 hrs at 12 months) and asymptomatic (9 hrs at 6 months; 7 hrs at 12 months) recipients.

Conclusions: Cautiously interpreting our data reveals difference in the timing to, utilization of and performance with cochlear implantation in children with symptomatic vs asymptomatic congenital CMV. It is unclear if this is secondary to medical complexity, social determinants or both.

Primary Author/Presenter: Kathryn Tribulski

Author Block: Kathryn Tribulski, AuD1, Elizabeth Hernandez, SLP2, Cedric Pritchett, M.D.3;1Audiology, Nemours Children's Hosp., Orlando, FL, 2Rehabilitation, Nemours Children's Hosp., Orlando, FL, 3Otolaryngology, Nemours Children's Hosp., Orlando, FL.
Learner Objectives:

At the end of the session, participants will be able to identify variable outcomes possible for children with cCMV who are implanted.

At the end of the session, participants will be able to determine variants of familial/guardian support and how it could effect outcomes.
Abstract Content:

Introduction: The Active Insertion Monitoring (AIM) System is characterized as a surgical and audiological platform that enables real-time intraoperative and postoperative objective measurements in patients with Advanced Bionics cochlear implants. Among the objective measurements performed by the system, the automatic acquisition of Neural Response Imaging (NRI) represents the responsiveness of the auditory nerve to electrical stimulation, making it a valuable tool for CI programming in young children and difficulty patients. The aims of this study were to compare the Neural Response Images (NRI) obtained in the AIM system and the measurements obtained in the SoundWave programming system and to compare the recording times of the measurements in both systems.

Methods: Prospective study which assessed the Neural Response Image (NRI) of 70 subjects implanted with Advanced Bionics cochlear implants. Patients were included in the study considering the following inclusion criteria: full insertion of the electrodes, normal impedances and presence of Neural Response Image. Neural response Images (after impedance measurements) were taken at the same electrodes (3, 7, 11, 15) for all patients using the AIM System as well as SoundWave programming system. Both measurements and their recording times were compared.

Results: The results showed a correlation between the NRI taken with the AIM system and those taken with the SoundWave programming system both intraoperatively and postoperatively. The recording time was substantially shorter for measurements obtained by AIM system.

Conclusion: The results suggested that the AIM system can be used as a valid and effective clinical tool for recording objective measurements in cochlear implant users.

Primary Author/Presenter: Marina Vuljanic

Author Block: Marina M. Vuljanic, Audiologist, Norma Pallares, Magister in Audiology, Vicente Diamante, PhD and Professor; Audiolgia, Centro de Implantes Cocleares Prof. Diamante, CABA, Argentina.

Learner Objectives:

Compare the Neural Response Images (NRI) obtained in the AIM system and the measurements obtained in the SoundWave programming system.

Compare the recording time of the measurements of Neural Response Images (NRI) obtained with the use of the AIM system and the recording time of the measurements obtained with the use of SoundWave programming system.
Early Experience Measuring Daily Impedance by Remote Check in Cochlear™ Nucleus® Cochlear Implant Recipients

Introduction: Increases in electrode impedance have been associated with delayed loss of residual acoustic hearing, suggesting possible intracochlear inflammation or fibrosis tissue growth after cochlear implant (CI) surgery (Scheperle et al., 2017; Shaul et al., 2019; Tejani et al., 2022). It is crucial to understand how the cochlear tissue changes over time postoperatively. Electrode impedance measures collected at programming appointments within the first 6 months post-surgery can be monitored as a marker of potential fibrosis and ossification. However, our understanding of the course of impedance changes would be expanded if we were to make frequent impedance measures between cochlear implant programming follow-up appointments. Recently, such intense monitoring of impedance changes following implant surgery and activation have become possible due to the release of Cochlear™ Nucleus® Remote Check, a new function incorporated in the Cochlear™ Nucleus® Smart App. This presentation describes our first experience using the Remote Check to monitor patients’ daily impedances postoperatively.

Methods: To date, four patients (four ears) have been recruited for this project. Total impedance measures were administrated daily by participants for the first 60 days starting with their initial activation using the Remote Check tool provided by the Cochlear™ Nucleus® Smart App. Data on impedance check from automated direct measures were updated in the online database on a daily basis.

Results: Our preliminary data shows total impedances measured daily by two study participants with regular Cochlear™ Nucleus® CIs for the first 60 days post CI using Remote Check. This data demonstrates the feasibility of operating daily electrode impedance measures by patients themselves.

Conclusion: The data quality of the daily impedance measures using the Remote check was good. The stated method is feasible to monitor electrical impedance over time in patients postoperatively. Remote Check is a promising tool to incorporate daily impedance checks into patients' postoperative habilitation routine and help clinicians to better monitor patients’ implant status and intracochlear physiological changes.

Primary Author/Presenter: Yi Yuan

Author Block: Yi Yuan, PhD1, Christine Etler, AuD2, Viral Tejani, PhD3, Camille Dunn, PhD2, Shuman He, MD PhD1, Marlan Hansen, MD2; 1Otolaryngology, The Ohio State Univ. Wexner Med. Ctr., Columbus, OH, 2Otolaryngology, Univ. of Iowa Hosp. and Clinics, Iowa City, IA, 3Otolaryngology, Univ. Hosp. Cleveland Med. Ctr., Cleveland, OH.

Learner Objectives:

discuss the feasibility of performing daily impedance checks using Cochlear Remote Check
Introduction: Current approved FDA guidelines support candidates with bilateral moderate to profound low frequency and profound mid to high-frequency sensorineural hearing loss scoring 60% in the best-aided condition and 50% in the ear to be implanted on a sentence task may qualify for a cochlear implant (CI). Per these guidelines, most clinics have adopted a clinical protocol evaluating a patient’s ability of open set sentence recognition using recorded test metrics. In recent years, there is an indication for candidates with unilateral hearing loss or single sided deafness (SSD). Two of the 3 CI manufacturers have received FDA approval for the SSD indication, with some insurance companies providing coverage for these candidates. However, there does not appear to be a consensus across clinics regarding a streamlined protocol to determine appropriate candidacy for this population. Moreover, when it comes to programming considerations, there is a current paucity of data given the recent U.S. approval of the indication. Additionally, there does not appear to be a streamlined approach to post-implant activation clinical protocols for this population subset. Given the unique characteristics associated with SSD, this is an important consideration. Most clinics do not have the appropriate calibrated direct connect equipment to test this population or the speaker configuration to assess localization abilities. Clinicians must determine who is an appropriate candidate based on a variety of different factors such as duration of deafness, presence of tinnitus and previous experience with more traditional interventions such as a CROS aid or BAHA device. Traditional protocols are generally employed for programming, despite the fact the patient has a normal hearing contralateral ear, and therefore, may need to be programmed differently than a traditional CI recipient. The purpose of this retrospective study was to examine the pre-operative, programming and post-operative protocols used to determine candidacy, to program the device and to assess outcomes for individuals with single sided deafness.

Methods: Pre-operative and 3 month post-operative audiometric and speech perception testing for 10 single sided deaf CI recipients was reviewed. Average duration of deafness for this group of individuals was less than 10 years. Pre-operative and 3- month post-operative CNC word scores, BKB-SIN and Quick SIN scores are reported. Programming protocols utilizing standardized and alternate frequency allocation tables (FAT) are also described, quantitative and qualitative. Results: At three months post-implantation, on average, subjects showed an improvement on CNC word scores in quiet with CI alone and BKB-SIN and Quick Sin scores when speech was presented to the front and noise was presented to the normal ear. Conclusion: The data from this study suggests that individuals with single sided deafness can obtain significant benefit from a CI, especially in noisy environments. On average, significant improvements were also noted in word recognition scores with the CI alone. Since a standardized protocol for testing individuals with single sided deafness does not exist, clinics should consider adopting a protocol for pre-and post-operative protocols for this population, as well as consideration of the use of an alternate frequency allocation table for these individuals given the normal hearing contralateral ear.
CI2023 Dallas: Cochlear Implants in Children and Adults

Participants will be able to describe a unique protocol for determining candidacy and assessing outcomes for patients with single-sided deafness.

Participants will be able to identify changes in frequency allocation tables that may improve sound quality for CI recipients with single-sided deafness.
Abstract Content:

Introduction: The advancement of auditory skills in pediatric cochlear implant (CI) users varies widely, with factors such as earlier age at implantation, longer duration of device use, and absence of comorbid conditions corresponding to more advanced speech recognition abilities. However, research on this topic often uses an age-appropriate yet site-specific test batteries, which restricts direct comparison across studies. The Pediatric Minimum Speech Test Battery (PMSTB), a standardized pediatric audiologic testing protocol, allows monitoring of a child’s auditory progress via speech discrimination, word and sentence recognition in quiet, and sentence recognition in noise (Uhler et al., 2017). No studies to date track progression of children with CIs through the PMSTB. This study uses retrospectively collected clinical data as a first attempt to assess the trajectory or auditory skill acquisition in children via the PMSTB in pediatric CI users.

Methods: Data collection is ongoing, but the sample currently includes 14 children who use CIs and have no comorbid conditions (e.g., syndromes). Most participants were identified as deaf/hard of hearing at birth, received hearing aids by a median age of 7 months (Range: 1-53 months), and had their first CI activated at a median age of 17 months (Range: 11-58 months). Of the current sample, all use binaural devices (12 bilateral CIs, 2 bimodal with 1 CI + 1 contralateral hearing aid). Data collection across participants ranged in chronologic age from 2 to 71 months and ranged in CI device experience from 2 to 44 months. All participants completed at least one measure on the PMSTB, a hierarchical test battery with measures ranging from parent report (LitlEARS) to a speech discrimination task to speech recognition testing (i.e., word and sentence stimuli, quiet and competing signal conditions, and closed- and open-set tasks). The PMSTB recommends proceeding to the next testing level with scores ≥80% in 2 sessions.

Results: Eleven parents completed the LitlEARS for children with 0-24 months of CI experience. Five attained scores ≥80% with 2-7 months of CI experience. Five of seven children who attempted a closed-set speech recognition task had at least some word recognition with 24-30 months of CI experience. Eight children achieved open-set speech recognition by 44 months of CI experience.

Conclusion: Preliminary results show vast variability in auditory skills and speech recognition outcomes in pediatric CI users. Earlier-implanted children tend to move through the PMSTB faster than later-implanted children. However, a larger, more diverse sample would help parse the influence of demographic factors on speech recognition outcomes in young CI recipients.

Primary Author/Presenter: Grace Phelps


Learner Objectives:

Describe the components and tenets of the Pediatric Minimum Speech Test Battery.
Describe how pediatric cochlear implant users, on average, progress through the Pediatric Minimum Speech Test Battery after device activation.
**Abstract Content:**

Introduction: Cochlear implantation is the standard of care for treating severe to profound hearing loss in all age groups. There is limited data on long-term results in elderly implantees and the effect of ageing on outcomes. This study will focus on patients over 80 years old or more at the time of implantation and their results.

Methods: A retrospective chart review of cochlear implant patients who are over 80 years old. Hearing in Noise Test scores, duration of use and quality of life metrics were collected.

Results: The study included 211 patients with a mean follow up of 6.3 years. All the patients were older than 80 years at the time of implantation. The age range was 80-100 with an average of 84. 62 patients deceased during the follow up. Four implants were explanted due to various reasons. Cochlear implantation in patients aged older than 80 years is associated with a significantly improved quality of life. Cochlear implant function as measured by Hearing in Noise Test scores were marginally poorer in elderly than in younger patients, but was stable over time.

Conclusion: Cochlear implantation improves both audiometric outcome and quality of life in elderly patients. These benefits are stable over time.

**Primary Author/Presenter:** Demir Bajin

**Learner Objectives:**

Considerations for cochlear implantation in elderly patient group.

Outcomes of cochlear implantation over the age 80.
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

**Poster Category:** Audiology

**Poster Exhibit Number:** 32

**Abstract Number:** 217

**Poster/Abstract Title:** Results of cochlear implant in children with unilateral and asymmetric deafness due to congenital cytomegalovirus infection

**Abstract Content:**

Introduction: Among 2500 surgeries in both children and adults with deafness due to different etiologies at our cochlear implant (CI) group, we identified 53 (2.1%) children diagnosed with congenital cytomegalovirus (CMV) infection with bilateral severe to profound deafness. Children with unilateral deafness or asymmetric hearing loss were periodically followed up, but without indication for CI. With recent studies that show the reactivation and/or progression of hearing loss in those children with congenital CMV infection, we believe in the importance of monitoring the auditory development and candidacy assessment for cochlear implant in the worst ear.

**Methods:** Children diagnosed with congenital CMV infection who were admitted at our group between 2020 and 2022 underwent pure tone audiometry, behavioral and electrophysiological assessment, hearing aid fitting, language assessment and evaluation with a neuropediatrician.

**Results:** In the selected period, 18 children diagnosed with deafness due to congenital CMV infection were evaluated. Fourteen (77%) had severe to profound bilateral sensorineural deafness, receiving indication for bilateral cochlear implantation. Two children (A: 2 years old; B: 4 years old) presented unilateral deafness, with SSD diagnosis in the first year of life and normal language development without benefit with hearing aids in the ear with profound deafness and were indicated for CI. Child A is currently using the unilateral CI for 1 year and is in auditory perception category 4 with the CI alone. Child B was just implanted and has not been activated yet. Two other children (C and D: 2 years old) had asymmetric hearing loss. Child C had pure tone thresholds average (PTA) of 55 dBHL in the best ear and 115 dBHL in the worst ear, in addition to a diagnoses of autism. This child was indicated to CI in the worst ear maintaining bimodal stimulation, with hearing aid in the best ear. After two years of CI use, the responses to sounds are unreliable, due to the associated impairment. No oral language development was evidenced. Child D had asymmetric hearing loss at diagnosis, with a PTA of 40 dBHL in the best ear and 90 dBHL in the worst ear. Six months after the hearing aid fitting and audiological follow-up, we noticed a significant worsening of hearing in the best ear, with thresholds at 90 dB. This child was developing oral language and received bilateral CI. After two years of CI, the patient has access to all speech sounds bilaterally, but with significant language delay, despite not having associated impairments identified by the neuropediatrician.

**Conclusion:** Children with unilateral deafness and asymmetric hearing loss, diagnosed with congenital CMV infection, should have their hearing monitored, especially the best ear. We believe that the number of children that fit this profile will significantly increase, which claims for the attention of a multidisciplinary team.

**Primary Author/Presenter:** Paola Samuel

**Author Block:** Ana Cristina Hoshino, PhD1, Paola Samuel, Doctorate degree2, M. Valéria S. Goffi-Gomez, Post doctorate degree2, Robinson K. Tsuji, Post doctorate degree2, Ricardo F. Bento, Chairman Professor2;1Otorhinolaryngology, Univ.e de Sao Paulo, Sao Paulo, Brazil, 2Otorhinolaryngology, Hosp. das Clinicas FMUSP, Sao Paulo, Brazil.

**Learner Objectives:**
CI2023 Dallas: Cochlear Implants in Children and Adults

Discuss the results of cochlear implant in children with SSD and asymmetric deafness due to congenital cytomegalovirus infection
Introduction: Patients with moderate-to-profound unilateral hearing loss (UHL), also known as single-sided deafness, frequently report bothersome or debilitating tinnitus. A majority of adults with UHL report tinnitus suppression as a reason for pursuing cochlear implantation. Cochlear implantation and/or cochlear implant (CI) use reduces tinnitus perception for many adult CI users with UHL, although not for all. The present report reviewed the effectiveness of a modified mapping procedure that was aimed to reduce tinnitus severity in an adult CI user with UHL. Methods: A modified mapping procedure was attempted to reduce tinnitus severity. The frequency region of the tinnitus was first measured using a pitch comparison task between the implanted and contralateral, normal hearing ear. The electric threshold levels for the channels that included this frequency range were increased in an attempt to mask the perceived tinnitus. The Tinnitus Handicap Inventory (THI) was completed to evaluate the effects on the perceived tinnitus severity. Results: The participant reported a THI score of 98 at the preoperative evaluation, which is a catastrophic handicap on her daily life. A 1-month post-activation, the participant reported a reduction in her perceived tinnitus with CI use that was ranked as a severe handicap on the THI. The tinnitus pitch matching task was completed at the 3-month post-activation visit. Electric threshold levels (Ts) were increased by 6u on E11 and E12 and the participant reported a reduction in her tinnitus severity. By the 6-month visit, the reported tinnitus severity with CI use was reduced to a moderate handicap on the THI. Conclusion: While cochlear implantation results in a reduction of tinnitus severity for many CI recipients, some CI users may benefit from modified mapping procedures aimed at masking the perceived tinnitus.
**Abstract Content:**

Introduction: The candidacy evaluation for cochlear implantation involves multiple hours of assessments (e.g., unaided and aided hearing abilities, imaging, and surgical discussion) and counseling (e.g., devices, surgical procedures, and post-operative management). The response to the COVID-19 pandemic challenged the effectiveness of the counseling portion of the evaluation process. Patients were restricted to one support person during in-person visits, limiting family involvement in the process. Required facial coverings significantly reduced speech understanding, creating challenges during counseling. To improve the counseling portion of the cochlear implantation evaluation, our team offered patients virtual visits. This report reviews the effectiveness of this modified procedure that was aimed to improve the patient experience in the post COVID-19 era.

Methods: The virtual visit was offered to adults who were referred for a cochlear implantation evaluation prior to their in-person visit. Four audiologists who are specialized in treatment and management of cochlear implant (CI) patients developed a presentation on the topics covered during the counseling portion of the cochlear implantation evaluation. During the 30-minute virtual visit, the audiologist would obtain a detailed case history, complete a cognitive screener, review the presentation, and answer the questions from the patient and/or their family. Following the virtual pre-evaluation counseling visit, patients would either continue with the in-person cochlear implantation evaluation, proceed with consultations for other hearing technologies (e.g., hearing aids), or cancel the in-person cochlear implantation evaluation.

Results: The virtual pre-evaluation counseling visit has increased the efficiency of the in-person cochlear implantation evaluation visit since patients have an improved understanding of the process. It has also improved time management since patients better suited for alternative technology are re-scheduled for a consultation for the more appropriate technology. Taken together, this saves time for the patient and the clinic.

Conclusion: The implementation of a virtual pre-evaluation counseling visit for patients referred for a cochlear implantation evaluation has been an effective way to manage patients and provide counseling without extensive travel. We found a reduction in the number of no-shows for the in-person cochlear implantation visit, in incorrectly-scheduled appointments, and overall improvement in patient satisfaction with the evaluation process.

**Primary Author/Presenter:** Noelle Roth

**Author Block:** Noelle E. Roth, Au.D.1, Andrea B. Overton, Au.D.1, Margaret E. Richter, Au.D.2, Allison Young, Au.D.1, Alyssa Flippo, Au.D.1, Sarah M. Dillon, Au.D.1, Margaret T. Dillon, Au.D., Ph.D.2; 1Audiology, UNC Health, Chapel Hill, NC, 2Otolaryngology/Head & Neck Surgery, Univ. of North Carolina at Chapel Hill, Chapel Hill, NC.

**Learner Objectives:**

At the end of the session, participants will be able to discuss the practicality of virtual care in the cochlear evaluation process.
CI2023 Dallas: Cochlear Implants in Children and Adults

At the end of the session, participants will be able to explain the effectiveness pre-evaluation counseling
Introduction: To determine the improvement in speech perception after cochlear implant (CI) surgery in candidates with preoperative hearing threshold ≤80 dB HL in the low frequencies (WHO 2&3). Methods: Retrospective review of all adult patients who received a cochlear implant between January 2015 and December 2021. The inclusion criteria were a preoperative hearing threshold ≤80 dB HL in at least one ear. Postoperative speech recognition scores at least six months post activation available. Results: The inclusion criteria were met by 160 patients. 155 patients showed a significant speech perception improvement six months after activation. Preoperative audiometric measures, the maximum word recognition score, age at implantation, and word recognition scores were identified as predictive factors for post implantation word recognition scores. Conclusion: For WHO 2&3 candidates cochlear implantation should be considered when speech perception with a conventional hearing aid is insufficient.

Primary Author/Presenter: Philipp Mittmann

Author Block: Philipp Mittmann, MD, Arne Ernst, MD, Gina Lauer, MD; Unfallkrankenhaus Berlin, Berlin, Germany.

Learner Objectives:
estimate the benefit from cochlear implantation in a population severe hearing impaired patients.
Introduction: Patients who present with moderate-to-profound asymmetric hearing loss (AHL), including cases of single-sided deafness or unilateral hearing loss (UHL), report poor speech perception in noise, localization, and quality of life. Prior investigations have demonstrated cochlear implantation of the poorer hearing ear is a viable treatment option for these patients. Cochlear implant (CI) recipients with AHL experience improved speech perception in noise, localization, and quality of life as compared to unaided conditions or when listening with CROS hearing aids or bone conduction hearing aids (BCHAs). With the 2019 and 2022 FDA approval of cochlear implantation (CI) in cases of UHL and AHL, CI teams are seeing an increase in the UHL and AHL patient populations. Inclusion criteria for clinical trials are typically less variable than encountered in the clinical population, thus this presents an opportunity to compare clinical UHL and AHL recipients to subjects participating in a clinical trial on CI in UHL and AHL. The present report compares this clinical population to research participants and discusses how this information can be used to help inform clinical care.

Methods: Forty subjects received a CI as part of a FDA clinical trial investigating cochlear implantation in cases of UHL and AHL. At present, there are 88 adult recipients in the clinical UHL/AHL population with 41 meeting UHL criteria and 47 meeting AHL criteria. This presents a unique opportunity to compare demographic variables and trends in outcomes between the groups including electrode array choice, age at implantation, speech perception outcomes, and insurance coverage. Results: Recipients experienced significant improvement in speech performance with their CI as compared to their preoperative performance with a hearing aid or BCHA. Average age at implantation of UHL clinical population was 49 years of age (range 25-72) and age at implantation of the AHL clinical population was 59 years of age (range 19-84) as compared to research participants who were an average of 50 years (UHL) and 70 years (AHL). Further analysis of insurance payer, electrode array choice, and speech performance will be discussed.

Conclusion: Patients with UHL or AHL experience improved speech perception, localization, and quality of life with the use of a CI. Cochlear implant teams must consider multiple variables including electrode array choice, careful candidacy evaluation, insurance coverage, optimal test battery, and mapping procedures to be good stewards of hearing healthcare resources and effectively evaluate and treat CI recipients with normal to near-normal hearing in the contralateral ear.

Primary Author/Presenter: Andrea Overton

Author Block: Andrea Overton, AuD1, English King, AuD1, Meredith Rooth, AuD2, Margaret Richter, AuD2, Sarah Dillon, AuD1, Matthew Dedmon, MD, PhD2, Kevin Brown, MD, PhD2, Margaret Dillon, AuD, PhD2;1Department of Audiology, UNC Hosp., Chapel Hill, NC, 2Dept of Otolaryngology - ENT, Univ. of North Carolina, Chapel Hill, NC.

Learner Objectives:

At the end of the session, participants will be able to summarize trends related to clinical transition and feasibility of caring for cochlear implant recipients with UHL/AHL.
At the end of the session, participants will be able to describe a clinically feasible testing regimen for cochlear implant recipients with UHL/AHL.
Abstract Content:
Introduction: Cochlear implants (CIs) can improve CI users’ voices. This reflects the key role that auditory feedback provides for monitoring and controlling one’s voice, something referred to as the perception-production loop. These improvements indicate that CI users are receiving usable auditory feedback and making use of that feedback to control their voice. However, there is evidence that the feedback that CI users receive is distorted, decreasing the reliability of the perception-production loop for vocal control for this population. This issue may be compounded for bilateral CI users. Bilateral CI users often hear different sounds with their left and right ear, suggesting that the resulting auditory feedback may be conflicting and thus more detrimental than helpful. The aim of this research is to examine how using bilateral CIs affect F0 and intensity vocal control relative to unilateral CI use.

Methods: Six bilateral CI users were tested. Participants’ voices were recorded while they produced sustained vowels. They produced these vocalizations when using either their left CI, right CI, both CIs or neither CI. Their voices were analyzed in terms of F0 and intensity.

Results: F0 control was worse when using both CIs together than when using their better CI alone. Intensity control was better when using both CIs together for some participants and worse when using both CIs together for others. However, intensity control was typically better when using both CIs together than when using neither CI.

Conclusion: The results suggest that bilateral CI use can be detrimental to vocal control compared to unilateral CI use in terms of F0 control, although the effects are less consistent in terms of intensity control. Further research is needed to understand what leads to these detrimental effects and why they occur inconsistently.

Primary Author/Presenter: Justin Aronoff

Author Block: Justin Aronoff, PhD, Simin Soleimanifar, MS; Speech and Hearing Science, Univ. of Illinois at Urbana-Champaign, Champaign, IL.

Learner Objectives:
- describe the effects of bilateral cochlear implants of vocal control
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: Audiology
Poster Exhibit Number: 38
Student Poster Competition?

Abstract Number: 271
Poster/Abstract Title: Profile of Pediatric Patients Presenting for Cochlear Implant Candidacy Evaluation at a High-Volume Cochlear Implant Center

Abstract Content:

Introduction: Historically, many referring providers have adhered to strict FDA-labeled indications for pediatric cochlear implantation (CI) that have been in place since 1990 despite substantial evidence supporting “off-label” cochlear implantation outside these guidelines. Fortunately, in recent years there has been some progress toward expansion of FDA-labeled indications, including addition of indications for single-sided deafness and asymmetric hearing loss for children ≥ 5 years of age in 2019 and the minimum age for a FDA-labeled CI indication being lowered to 9 months in 2020. In order to assess the impact of such changes and identify opportunities to improve access to pediatric CI, it is imperative to first understand the characteristics of the population of children currently being referred for CI candidacy evaluations. Thus, the primary purpose of this study was to describe the demographic, audiometric, and speech, language, and auditory abilities of the pediatric population presenting for CI candidacy evaluations at a high-volume pediatric CI center.

Secondary objectives included (1) investigation of racial and ethnic healthcare disparities amongst pediatric patients referred for CI and those that ultimately underwent CI surgery at this center and (2) assessment of the impact of evolving FDA criterion on the profile of pediatric candidates being referred for CI candidacy evaluation at this center.

Methods: Data were obtained from a retrospective review of medical records at a tertiary academic referral center. Inclusion criteria included pediatric patients that were (1) 18 years of age or younger at the time of CI candidacy evaluation and (2) underwent a CI candidacy evaluation between January 1, 2017 and December 31, 2021. Demographic information, preoperative audiometric thresholds, and results of preoperative speech perception testing and speech-language-auditory evaluations will be assessed.

Results: Data analysis for this study is ongoing. Results will include data from 309 children that underwent CI candidacy evaluation between 2017 and 2021. Data will be analyzed to describe the demographics, preoperative audiometric characteristics, and preoperative speech perception, auditory, speech, and language abilities of the population of children presenting for CI candidacy evaluation at this center. Additionally, analyses will include assessment of the influence of expanded FDA indications on the profile of pediatric candidates referred for evaluation by comparing the profile of candidates referred before and after these changes were made. Finally, the impact of race, ethnicity, insurance status, referral source, and home location (rural vs. urban) on the profile of children referred for candidacy evaluations will be evaluated.

Conclusion: The results of this study will describe the characteristics of children presenting for CI candidacy evaluation at a high-volume pediatric CI center and the influence of evolving FDA criterion on the characteristics of this population. These data can be used to help inform education and advocacy efforts aimed at expanding access to CI in the pediatric population.

Primary Author/Presenter: Christine Brown


Learner Objectives:
CI2023 Dallas: Cochlear Implants in Children and Adults

Describe the demographic and audiometric characteristics of pediatric patients commonly referred for cochlear implant candidacy evaluation at a high-volume pediatric CI center.

Describe racial and ethnic healthcare disparities amongst children who were referred for cochlear implant candidacy evaluations and those that ultimately underwent CI surgery.
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: Audiology

Poster Exhibit Number:  39  Student Poster Competition?

Abstract Number: 273

Poster/Abstract Title: Cochlear Implant And Tinnitus: A Prospective Cohort

Abstract Content:

Introduction: Approximately 1.5 billion people live with some degree of hearing loss worldwide; it is the major risk factor for tinnitus, a fact that can worsen quality of life and affect patients’ well-being and global health. Aims: objectively assessing cochlear implant (CI) influence on tinnitus perception before and after surgery based on validated questionnaires.

Methods: 30 adult patients with bilateral profound hearing loss, who were candidates to Cochlear Implant surgery, complaining of tinnitus, were assessed. The following questionnaires were applied: Tinnitus Handicap Inventory (THI) and Visual Analog Scale (VAS), at 4 different moments: pre-operative, 7 days, 3 and 6 months after Cochlear Implant surgery. Speech recognition test was carried out 6 months after surgery to measure functional gain after Cochlear Implant.

Results: Based on VAS, there was improved tinnitus perception 6 months after surgery, but such an improvement was not statistically significant. According to THI, there was improvement 3 months after surgery, but only the improvement recorded 6 months after surgery was statistically significant. It was not possible observing statistical correlation between hearing-loss time and hearing aids using time, and speech recognition test results. We also did not find correlation between THI and VAS change from pre-operative time to 6 months after surgery due to speech recognition test changes.

Conclusion: All aforementioned data prove the possibility of treating tinnitus through cochlear implant at different circumstances. Disarray in auditory pathway caused by hearing loss can be solved with auditory system reorganization based on a new input, such as cochlear implant. Tinnitus got better after Cochlear Implant surgery based on THI scores, but such improvement was only statistically significant 6 months after surgery.

Primary Author/Presenter: Pauliana Lamounier

Author Block: Pauliana Lamounier, MD1, Victoria F. Gonçalves, MD1, Isabela C. Queiroz, MD2, Debora A. Gobbo, Aud1, Claudiney C. Costa, PhD1, Hugo V. L. Ramos, PhD1, Faye Bahmad Jr, PhD2;1Department of Otorhinolaryngology, Rehabilitation and Readaptation Ctr. Dr. Henrique Santillo (CRER), Goiânia, Brazil, 2Department of Health Science, Univ. Of Brasilia, Brasília, Brazil.

Learner Objectives:

Evaluate the evolution of tinnitus and its influence on the quality of life of patients who underwent cochlear implant surgery. At the end of the session, participants will be able to note that we found that most patients have an improvement in tinnitus a
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: Audiology
Poster Exhibit Number: 40

Abstract Number: 275
Poster/Abstract Title: Early Post-Initial Stimulation Speech Understanding Performance Improvement in Cochlear Implant Patients with and without Anatomy-Based Fitting

Abstract Content:

Introduction: In May 2022, cochlear implant programming using anatomy-based fitting received FDA approval, and in October 2022, anatomy-based fitting software was released. Anatomy-based fitting theoretically allows the cochlear implant to better place-frequency match for each patient’s unique cochlea. It has been shown that closer place-frequency match is associated with better early speech understanding performance in cochlear implant users (Canfarotta et al., 2020). The otolaryngology program at our hospital keeps a comprehensive cochlear implant database. This database includes subjective and objective measures on cochlear implant patient outcomes, which provides an excellent opportunity to compare outcome measures of the past patients that did not receive anatomy-based fitting to new patients that have received anatomy-based fitting. Methods: Speech understanding performance data on post-lingually deafened adult cochlear implant patients programmed with and without anatomy-based fitting software were studied as a retrospective review. Only patients using the same cochlear implant manufacturer with an identical generation internal device were studied. Speech understanding performance data included CNC words and phonemes, AzBio sentences in quiet, and AzBio sentences in noise test scores. Data were analyzed by comparing the pre-operative aided scores to the post-initial stimulation scores at one and three months to determine pre-operative to post-initial stimulation performance improvement. This measure of improvement was then compared in patients programmed with and without anatomy-based fitting software. Results: Preliminary results will be presented. Conclusions: Anatomy-based fitting software was only recently released in the United States; thus, this data analysis study is currently taking place, as the data on patients that received programming with anatomy-based fitting software are in the process of being collected. The data analysis performed will evaluate the value of anatomy-based fitting as it pertains to the early speech understanding performance improvement in cochlear implant recipients. Reference: Canfarotta, M. W., Dillon, M. T., Buss, E., Pillsbury, H. C., Brown, K. D., & O’Connell, B. P. (2020). Frequency-to-place mismatch: Characterizing variability and the influence on speech perception outcomes in cochlear implant recipients. <i>Ear & Hearing</i>, 41(5), 1349–1361. https://journals.lww.com/ear-hearing/Fulltext/2020/09000/Frequency_to_Place_Mismatch__Characterizing.27.aspx

Primary Author/Presenter: Anna Louthan

Author Block: Anna Louthan, AuD1, Allen Derina, AuD1, Stephanie Moody, MD2;1Audiology, Eastern Virginia Med. Sch., Norfolk, VA, 2Otolaryngology, Eastern Virginia Med. Sch., Norfolk, VA.

Learner Objectives:

At the end of the session, participants will be able to compare the early speech understanding performance improvement in cochlear implant recipients with and without anatomy-based fitting
At the end of the session, participants will be able to discuss the value of anatomy-based fitting as an advanced programming method for cochlear implant recipients.
Abstract Content:

Introduction: Numerous studies have shown that many patients with hearing loss that have a cochlear implant (CI) experience a suppression of tinnitus when their CI is turned on. However, the neural correlates of this suppression are currently unknown. Additionally, CI patients exhibit higher degrees of cross-modal plasticity than normal-hearing (NH) individuals. Cross-modal plasticity can be quantified as the degree of auditory cortex activation to a visual stimulus. This study compares the brain activity using high density EEG (electroencephalography) related elicited by visual stimuli in conditions where CI users with single-sided deafness were experiencing tinnitus versus no tinnitus. We hypothesized that CI users with SSD that experience greater degrees of self-reported tinnitus suppression will also have greater degrees of cross-modal plasticity than SSD CI patients with less or no suppression of tinnitus.

Methods: Before the collection of EEG data, an online questionnaire was sent to existing SSD users. The survey quantified the subjective tinnitus loudness and annoyance when the CI is turned on versus off using a Likert scale from 1 to 10. Patients who completed the questionnaire completed a face versus house discrimination task with their CI on and off while recording 64-channel EEG. The task consisted of ten blocks of 40 stimuli displayed in a random order, resulting in a total of 400 stimuli. There were four different stimulus conditions: upright face, upside down face, upright house, and upside down house. Participants were required to indicate via keyboard press whether a house or face was perceived. Evoked potentials and subsequent source analysis was performed. Left and right auditory cortex regions of interest were examined for activity related to cross-modal plasticity.

Results: Of the 34 CI users with SSD that completed the survey, 21 reported a reduction in perceived tinnitus loudness ranging from complete suppression to very little suppression. A subset of the participants completed the EEG portion of the study (n=11). These initial data showed that participants with tinnitus suppression (from the CI being turned on) had elevated left and right auditory cortex activation compared to those who did not report tinnitus suppression. Conclusion: These pilot data confirm previous studies showing that a CI can help suppress tinnitus to varying degrees. Moreover, these data also suggest that tinnitus in SSD CI users may arise from “maladaptive” cross modal activation that is reduced once the CI is switched on.

Primary Author/Presenter: Andrew Dimitrijevic

Author Block: Mina Stojanovic, BSC, Joseph Chen, MD, Vincent Lin, MD, Trung Le, MD PHD, Amy Ng, MSC, Andrew Dimitrijevic, PHD, Kari Smilksy, MSC;Otolaryngology, Sunnybrook Hlth. Sci. Ctr., Toronto, Canada.

Learner Objectives:

What is crossmodal plasticity?

How does neural plasticity modulate tinnitus?
Abstract Content:

Introduction: As a large cochlear implant center in Los Angeles, California, increasing efficiency in order to provide the finest quality care is always our mission. Other clinic goals include, optimizing in-person time for those who truly need in-person care, reducing wait time for appointments, supporting clinic growth, and reducing the burden of time and/or travel expenses for patients, as we treat patients from all over California and worldwide.

Methods: Adult cochlear implant recipients were chosen to participate in our Remote Care pilot study. Patients who had received the Cochlear America’s brand cochlear implant systems and utilized either the Nucleus 7 or Kansi 2 sound processors were included in the study. Participants were those deemed technologically savvy, by having previously signed up for our online hospital portal and those who had been previously signed up for, and used, Cochlear America’s smart phone application. Participants also had been cochlear implant users for at least a year. Audiologists sent written messages through the online hospital portal, notifying potential participants about the new Remote Care technology and those patients were invited to participate. Interested patients were then enrolled through Cochlear America’s online professional portal. Remote Care was completed through a compatible personal device. Patients were then seen via video visits to discuss results and to determine if in-person follow up was needed. Remote Assist was utilized, when needed, to make necessary programming changes.

Results: Participants were able to successfully complete their Remote Care activities within a reasonable time frame. Participants were able to save time and money by completing Remote Care versus coming in for an in-person appointment. Those needing in-person care were easily identified through their completed Remote Care results and with follow-up video visit. Patient wait times were reduced as a result of allowing eligible patients to access care remotely rather than waiting to be seen in clinic.

Conclusion: Implementing Remote Care into our large, hospital based cochlear implant program was simple and beneficial for both clinicians and patients with the Cochlear America’s brand cochlear implants. The pilot study helped to distinguish the appropriate communication methods for prospective participants in the program. The study also helped to isolate how asynchronous Remote Care and synchronous follow up video visits could potentially substitute the need for in-person visits for patients who have established steady performance with their cochlear implant devices. Patients needing more in-person support were successfully identified through their Remote Care results and follow-up video visits. Overall, more in-person appointment slots were available to those needing in-person support, with less wait time. We believe we will see even greater impact as we enroll more patients to participate.

Primary Author/Presenter: Denise Kidd-Conover


Learner Objectives:

discuss how Remote Care can be easily be adopted into a hospital based cochlear implant program.

discuss how Remote Care is able to reduce financial burden and time constraints on patients and clinicians.
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: Audiology
Poster Exhibit Number: 43  Student Poster Competition? Yes

Abstract Number: 291
Poster/Abstract Title: Utility of a Pitch Ranking Task in the Individualization of Filter Frequencies to Improve Sound Quality and Performance: A Case Study

Abstract Content:
Introduction: Multichannel cochlear implants (CIs) capitalize on the natural tonotopic organization of the cochlea and the auditory nerve fibers to improve frequency resolution and speech recognition. The incoming frequency information is divided and presented by specific electrode contacts that are assumed to mimic the natural tonotopic organization. Some CI recipients are unable to discriminate pitch differences between adjacent contacts, resulting in poorer spectral resolution. Other CI recipients may experience pitch reversals, which are when a more basally positioned electrode contact generates a lower frequency pitch percept as compared to a more apically positioned electrode contact. Pitch reversals result in poorer sound quality and negatively influence speech recognition for CI users (Kenway et al., 2015). The present case study reviews how to identify pitch reversals in CI users and how modified filter frequencies can improve patient outcomes.

Methods: A pitch ranking task was completed at the 3-month post-activation visit as part of a clinical research study. The participant responded to whether stimulation from adjacent electrode contacts were higher or lower in pitch. Filter frequencies were modified for the electrode contacts identified to have a pitch reversal. Speech recognition was evaluated with the implanted ear alone using CNC words in quiet and in the best-aided condition using AzBio sentences in a 10-talker masker at 0 dB SNR. Performance in the combined condition was assessed with the target from the front and the masker either colocated (SoNo) or 90 degrees towards the implanted ear (SoNeas).

Results: The participant listened with an electric-acoustic stimulation (EAS) device. At the 3-month post-activation visit, her CNC word score with EAS alone was 58%. Her performance in the combined condition was 46% for SoNo and 88% for SoNeas. The pitch ranking task identified pitch reversals between two electrode contact pairs (E10 and E11, and E11 and E12). The filter frequencies for these channels were modified in response to the pitch reversals. The participant returned 3 months later and reported an improvement in sound quality. Her CNC word score with EAS alone was 64%. Her performance in the combined condition was 47% for SoNo and 99% for SoNeas.

Conclusion: The pitch ranking task identified pitch reversals for a patient experiencing typical performance expected for an EAS user. Individualizing the filter frequencies in response to the pitch reversal resulted in improved sound quality and performance. These findings suggest the importance of test methods and mapping procedures aimed at helping individuals achieve their best outcomes with a cochlear implant.

Primary Author/Presenter: Jacqueline Eberhard

Author Block: Jacqueline Eberhard, Bachelor's of Science1, Margaret Richter, AuD2, Margaret Dillon, AuD, PhD2; 1Division of Speech & Hearing Sciences, Univ. of North Carolina at Chapel Hill Sch. of Med., Chapel Hill, NC, 2Department of Otolaryngology: Head & Neck Surgery, Univ. of North Carolina at Chapel Hill Sch. of Med., Chapel Hill, NC.

Learner Objectives:
At the end of this session, participants will be able to identify when pitch reversals have occurred and employ the pitch ranking task for clinical use.
Abstract Content:

Introduction: Spanish is the second most widely spoken language in the United States, with nearly 41 million people speaking Spanish at home. Until recently, there were limited standardized test options to evaluate for cochlear implant candidacy for this population. Of the previously available options, clinicians risked a ceiling effect, thus overestimating a patients’ speech understanding, due to the testing being easy. The Spanish Az-Bio sentences were released on 2021. Per the instructions, it is recommended that a Spanish speaking clinician or a professionally tried Spanish interpreter score the sentences. Unfortunately, not all clinics have access to a Spanish speaking provider or are fortunate enough to be able to train a professional Spanish interpreter prior to testing for all patients. This leaves many English-speaking providers scoring the Spanish Az-Bio. The aim of this study is to assess the accuracy of English-speaking clinicians on scoring the Spanish Az-Bio.

Methods: A sample set of English-speaking audiologists, who have normal pure tone audiograms from 125-8000 Hz bilaterally will be collected. One audiologist, who is bilingual, will repeat the Spanish Az-Bio sentences from inside the calibrated booth, to ensure the exact score for each word list is known. Each native English-speaking participant will then score the Spanish Az-Bio in quiet and at a +10 signal to noise ratio. The accuracy of the scoring will be assessed in both quiet and in noise and be reported.

Results: (Pending. In process of collecting data). A total of X audiologists met the inclusion criteria of 1) normal hearing sensitivity from 125-8000 Hz bilaterally and 2) were native English speakers. The average accuracy was X% in quiet and Y% at +10 signal-to-noise ratio. X number of the audiologists indicated they received some form of Spanish instruction in high-school/undergrad (X took 0.5-2 years, Y took 2.5-4.5 years, and Z took 5+ years of Spanish). Conclusion: While the Spanish Az-Bio has improved the availability of accurate testing for Spanish speaking individuals with a hearing loss, there are still limitations that need to be considered when English-speaking clinicians are scoring results. Test results scored by an English-speaking provider should be interrupted with caution *** (Pending. In process of collecting data).

Primary Author/Presenter: Stephanie Rios

Author Block: Stephanie Rios, Doctor of Audiology1, Stevana Sullivan, Doctor of Audiology1, J. Connor Sullivan, Doctor of Audiology2;1Department of Otorhinolaryngology, The Univ. of Texas Hlth. Sci. Ctr. at Houston, Houston, TX, 2Baylor Coll. of Med., Houston, TX.

Learner Objectives:

Identify the accuracy of English-speaking clinicians on scoring the Spanish Az-Bio.
Abstract Content:

Introduction: The cochlear implant (CI) evaluation process requires audiologists to decide which speech perception tests are most appropriate for determining CI candidacy. Fortunately, the Minimum Speech Test Battery (MSTB) was established over a decade ago and is commonly used by audiologists who are managing English speaking adults. The MSTB has allowed clinicians to practice similar to their colleagues at other CI programs and has reduced barriers to CI access for English speakers. Regrettably, speech perception test protocols are not readily available for assessment of non-English speakers in the United States (US). Audiologists in specific areas of the US manage diverse patient populations and routinely encounter difficulties when assessing non-English speakers for CI candidacy. Portuguese is the 9th most spoken language in the world, and the US houses approximately 693,000 Portuguese speakers. Portuguese speakers can be found throughout the US but most commonly reside in California, Massachusetts, Rhode Island, New Jersey and Florida. Portuguese is the second most spoken language in Massachusetts and the third most spoken language in Rhode Island and Florida. This presentation will discuss how one CI program developed a test protocol to utilize with Portuguese speakers during the pre and post operative CI process. Development and utilization of a CI test protocol for Portuguese speakers decreases health disparities for this population by improving access to hearing healthcare. Methods: A Portuguese speaking audiologist at a large academic institution developed a Portuguese speech perception test protocol by completing a literature review of existing test measures and consulting with CI clinics in Brazil. The proposed protocol will describe the available measures that exist for Portuguese speaking patients and will follow a step-by-step process to assist clinicians with identifying the appropriate test to use for CI candidacy and post-operative care. Results: Unaided test protocol includes recorded Auditec Portuguese bisyllable word test presented at UCL minus 5 dB HL. Aided test protocol includes Auditec recorded Portuguese bisyllable word test presented at 60 dB SPL, Portuguese HINT sentences presented in live voice at 60 dB SPL in quiet, and Portuguese HINT sentences presented in live voice at 60 dB SPL with recorded Az Bio English babble noise in the second channel. Signal to noise ratio can be altered for more difficult test conditions and to overcome ceiling effects of HINT. If there are no Portuguese-speaking audiologists at the CI clinic, an interpreter or family member should be used for monitored live voice presentation. As HINT sentences are known to be negatively impacted by ceiling effect, audiologists may need to focus on aided bisyllable Portuguese word score for CI candidacy determination in patients who speak Portuguese. Conclusion: The US houses the most diverse population of any country in the world, yet access to hearing healthcare for English and non-English speakers is disproportional. Non-English speakers, including those who speak Portuguese, need improved access to CI centers and hearing loss treatment. In an attempt to reduce barriers to care, one institution developed and implemented a CI test protocol for use with Portuguese speakers. Implementation of the protocol can help to decrease health disparities for this population.
CI2023 Dallas: Cochlear Implants in Children and Adults

Describe the recommended protocol for pre and post operative assessment of Portuguese speakers

Introduction: Speech recognition performance is routinely assessed in cochlear implant (CI) patients. Speech scores are a decisive factor in determining CI candidacy and in monitoring postoperative performance. A large number of speech tests are available for testing CI patients including the Consonant-Nucleus-Consonant (CNC) word test and the AZBio sentence test. The primary aim of this study is to evaluate the use of the CNC word test versus the AZBio sentence test in determining candidacy and in measuring patient progress post implantation. That is, this study is conducted to analyze the degree to which these tests are comparable in evaluating CI patients, pre- and post-operatively. Few studies have compared the two tests in the same CI population to assess how well their results will correlate (e.g. Sladen et al. 2017). Furthermore, cognitive screening scores (obtained on the Mini-Cog test) will be used in the analysis of the results, as cognition was shown to contribute to the variability seen in speech recognition in CI patients. Thus, the secondary aim of this study is to evaluate correlations between speech and cognitive scores; and to see if this cognitive variable could predict variability in CI speech recognition outcomes - as measured using the CNC and the AZBio tests. We address the aims of this current study by retrospectively analyzing the data from a large sample of CI users collected at our center.

Methods: The participants in this study are adult CI users (≥ 18 years old) from our center. Data were collected between December 2018 and October 2022. Patients demographics and characteristics will be summarized in this presentation (e.g. age, gender, onset of hearing loss, type and degree of hearing loss, and primary mode of communication, etc.). The speech tests were conducted during 4 visits: 1 pre-implantation visit, and 3 post-implantation visits (at 3, 6, and 12 months post implantation). The speech tests were administered in a sound field with the participants seated at a 1-meter distance in front of the loudspeaker (at 0° azimuth). The tests were conducted at 60 dB A, using recorded material. Both tests were presented in quiet. The AZBio test was also conducted in noise at +10 dB SNR. Subject responses for the CNC word test were scored for phonemic and whole word accuracy. AZBio sentences were scored as the number of words correctly repeated by the patient. The Mini-Cog test was used to evaluate and screen the patients’ cognitive function (with total possible scores ranging from 0-5 points).

Results: This study is still in progress. Data from at least 50 CI patients will be described in this presentation. The results on the CNC and AZBio tests in the same CI patients will be assessed for correlations. The results will also be analyzed for correlations for cognitive differences among the patients (using the Mini-Cog scores). Multiple linear regression analyses will be performed between speech recognition and cognitive scores.

Conclusion: We anticipate that the use of monosyllabic words, used in the CNC word test, will be more appropriate for determining candidacy and monitoring patient progress post-implantation. Performance on the monosyllabic words may not approach ceiling levels for most patients, which will potentially facilitate the measurement of postoperative progress. Since sentence recognition relies on top-down processing, we anticipate that the AZBio performance will show stronger correlations with cognitive scores when compared to CNC word and phoneme scores.

Primary Author/Presenter: Dania Rishiq
Learner Objectives:

At the end of the session, participants will be able to compare the speech recognition performance of cochlear implant patients using two different speech tests.
Abstract Content:

Introduction: Despite extensive cochlear implant research since approval by the Food and Drug Administration (FDA) in 1985, a lack of evidence-based guidance for device programming remains. Existing programming guidelines cite evidence that is inconsistent, unreliable, and consists largely of expert opinion, and thus does not meet appropriate criteria for evidence-based practice. A scoping review, guided by the standards of the Preferred Reporting Items for Systematic Review and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR), was performed to identify peer-reviewed journal articles assessing speech perception outcomes of adult cochlear implant recipients with measured comfort and threshold levels. Methods: Systematic searches were performed in Embase, PubMed, and Web of Science, using a two-stage screening approach. Two individuals screened titles and abstracts and measured against inclusion criteria with the same two reviewing full texts. Studies with adults 18 years of age and older, information on programming method(s) used, and post-programming CI-only speech perception outcomes were included. No date limitations were applied, however, to keep consistency for outcomes, only those with English speech perception results were included. Literature searches were conducted September 2022 to October 2022. Results: A total of 1,011 abstracts were collected. After removing duplicates, 749 abstracts and titles were screened against inclusion criteria. After the second screening, 8 articles remained. Reasons for exclusion include incorrect population, non-English speech perception results, unknown programming method(s), inclusion of malformed cochleae, and/or lack of speech perception results. Using the American Academy of Audiology Cochlear Implant Programming Guidelines levels of evidence, the included articles were rated a 3 (Non-randomized intervention study) or 4 (Descriptive studies). Evidence demonstrates that cochlear implant optimization, through measured comfort and threshold levels, is favorable for adult recipients, despite variability in research design. Based on the critical appraisal of our 8 articles, using the Joanna Briggs Institute checklist, clinicians may consider extra attention to the setting of threshold levels and implementing objective measurements in the setting of comfort levels. Limitations of the studies include small sample sizes, lack of demographic information, and lack of inter-rater reliability for setting comfort and threshold levels. Conclusion: There is currently a lack of high-level evidence available in cochlear implant programming guidelines, and it is not appropriate for audiologists to modify their clinical practices at this time. In order for clinicians to continue to make evidence-based decisions, future research in cochlear implant programming focusing on appropriate setting of comfort and threshold levels is needed for this important treatment area.

Primary Author/Presenter: Diane Martinez

Author Block: Diane M. Martinez, AuDCommunication Sciences and Disorders, Univ. of South Florida, Tampa, FL.

Learner Objectives:
List 2 methods to optimally program a CI, based on the literature.
CI2023 Dallas: Cochlear Implants in Children and Adults

Identify limitations in the current CI programming literature
Introduction: Speech recognition in noise is one of the greatest challenges for cochlear implant users. Clinicians aim to individualize programming parameters for each patient to ensure audibility and discriminability of a range of speech sounds while mitigating interference due to noise. The objective of this study was to assess if patients with poor and better CI outcomes are fit with different sound coding and processing parameters to help them hear better in noise.

Methods: In this retrospective chart review study, adult CI recipients implanted with a mid-scalar electrode between 2017 and 2021 and with at least 40% speech recognition in quiet were included. Those without speech recognition test scores in noise in their medical records were excluded. Free field thresholds, recorded sentence recognition score in quiet and in speech/pink noise (SNR+10) and programming parameter settings (M and T levels, IDR, stimulation rate, pulse width, sound processing strategy, speech enhancement strategy status and strength) were collected. Difference in performance between quiet and noise was considered the variable for analysis as we wanted to focus not on how ‘good’ they were in noise, but how much their scores dropped in noise. Data were analyzed with Mann Whitney test comparing all the parameters of those who had less than 20% or more than 30% of difference between quiet and noise.

Results: Twenty-four patients were included. Group A had 12 patients whose difference between speech recognition in quiet and in noise was ≤ 20%, and Group B had 12 patients whose difference was ≥ 30%. Free field thresholds and speech recognition in quiet were statistically similar, showing that both groups were homogeneous. Statistical comparisons of programming parameters showed no significant differences across the two groups. In an analysis of individual data, a trend of better performance in noise was observed in patients with an IDR of 80dB.

Conclusion: If there are contributions to help patients cope with challenging environments, none of the studied parameters showed to be responsible for the difference between those who perform better in noise suggesting that the difficulty is not only related to the technology but to auditory system processing.

Primary Author/Presenter: Ana Cristina Hoshino

Author Block: Ana Cristina H. Hoshino, doctor1, Maria Valéria S. Goffi-Gomez, doctor1, Robinson K. Tsuji, doctor1, Ana Claudia Martinho, doctor2;1ENT, HCFMUSP, São Paulo, Brazil, 2Advanced Bionics, California, CA.

Learner Objectives:
The objective of this study was to assess if patients with poor and better CI outcomes are fit with different sound coding and processing parameters to help them hear better in noise.
Abstract Content:

Introduction: Although amplification does not provide pediatric cochlear implant (CI) candidates with adequate audibility of spoken language, earlier fitting of hearing aids (HA) is considered advantageous. Few studies have focused on the influence of auditory input on cortical structures in children who are CI candidates. This study evaluated the influence of pre-CI auditory input on brain structure.

Methods: T1-weighted whole-brain MRI of 98 CI candidates with congenital bilateral sensorineural hearing loss (SNHL) and no significant imaging brain abnormalities were compared to 82 normal hearing children from an NIH brain bank. Multivoxel pattern similarity analysis was used to examine gray matter morphology of the auditory cortex for CI candidates in comparison to controls. Multiple regression model and machine learning were used to examine the effects of residual hearing and length of amplification on auditory cortical changes controlling for age and gender.

Results: Children with longer HA use showed less cortical change in the left Heschl's gyrus (β = 0.196, p < 0.09). Such association was moderated by residual hearing (β = 0.276, p < 0.009). Specifically, children whose residual hearing were at and below the mean level (PTA ≥97.61 dB HL) showed significant association between HA use and cortical changes (below: B = 0.051, p < 0.008; mean: B = 0.023, p < 0.09), whereas children whose residual hearing were above the mean level (PTA < 97.61 dB HL) showed a weak and nonsignificant association (B = -0.005, p < 0.74).

Conclusion: Pre-operative HA use may prevent structural change in the auditory cortex, especially for CI candidates with profound SNHL. Despite not providing adequate audibility, amplification may mitigate the impact of auditory deprivation. Further research is needed to determine if preservation of morphology is predictive of better speech perception and language post-CI.

Primary Author/Presenter: Di Yuan

Author Block: Di Yuan, MSc1, Elizabeth Tournis, AuD2, Maura E. Ryan, MD3, Ching Man Lai, PhD1, Xiujuan Geng, PhD1, Nancy M. Young, MD4, Patrick C. M. Wong, PhD1;1The Chinese Univ. of Hong Kong, Hong Kong, China, 2Department of Audiology, Ann & Robert H. Lurie Children's Hosp. of Chicago, Chicago, IL, 3Ann & Robert H. Lurie Children's Hosp. of Chicago, Northwestern Univ. Feinberg Sch. of Med., Chicago, IL, 4Ann & Robert H. Lurie Children's Hosp. of Chicago, Northwestern Univ. Feinberg Sch. of Med., Chicago, IL.

Learner Objectives:

Describe the influence of auditory input on cortical structural changes in children with sensorineural hearing loss.
Abstract Content:
Introduction: In current audiological practice, routine cochlear implant programming uses a default frequency allocation to reproduce a tonotopicity that attempts to mimic the normal cochlea. When the default frequency programming is used, variations in the type of implant, CDL, and degree of insertion lead to discrepancies between the CF of the cochlea and the frequency presented to that part of the cochlea by the electrode. Frequency-to-place mismatches can occur in CI recipients when the frequency of the input signal differs from the CF of the neurons being stimulated by the electrodes of the implant in a normal cochlea. The magnitude of the frequency-to-place mismatch in each electrode and the predicted CF of contact with each electrode are not well known. The primary aim of this study was to determine the difference between the anatomy-based predicted frequency of each CI electrode and the default standard frequency settings used for all patients. The secondary objective was to study the magnitude of the frequency-to-place mismatch in each electrode and the CF of contact with each electrode.

Methods: Study Design: Retrospective study. Methods: A retrospective analysis was performed using computed tomography (CT) images of patients who received cochlear implants at a tertiary referral center. Patients were excluded if they had any congenital or acquired cochlear anatomical anomalies. The CT images of the patients were uploaded to the surgical planning software. Two independent reviewers allocated the anatomical parameters of the cochlea. The software then used these parameters to calculate the frequency allocation for each electrode according to the type of electrode and the length of the organ of Corti (OC) in each patient. These anatomy-based frequency allocations were compared with the default frequency settings. Main Outcome Measure: Frequency-to-place mismatch in semitones.

Results: Results: A total of 169 implanted ears in 102 patients were included in this study. The readings of the two reviewers were homogenous, with a Cronbach's alpha of 0.98. The mean anatomy-based frequency allocation was 487.3 ± 202.9 Hz in electrode 1; 9,298.6 ± 490.6 Hz in electrode 12. The anatomy-based frequency allocations were found to be significantly higher than the frequencies of the default frequencies for each corresponding electrode (one-sample t-test, P < .001). The frequency-to-place mismatch was negatively correlated with cochlear coverage and positively correlated with the cochlear duct length (Pearson correlation > 0.65, P < .003).

Conclusion: Conclusions: The anatomy-based frequency allocation of each electrode is significantly different from the default frequency setting. This frequency-to-place mismatch was affected mainly by the cochlear coverage.

Primary Author/Presenter: Isra Aljazeeri

Author Block: Isra A. Aljazeeri, Fellowship trained consultant otology neurotology1, Nezar Hamed, MD2, Yassin Abdelsamad, PhD3, Tahir Sharif, Bsc3, Murad Al-Momani, MD2, Abdulrahman Hagr, Professor4;1Otology, Ministry of health, Houfuf, Saudi Arabia, 2Otology, King Saud Univ., Riyadh, Saudi Arabia, 3Otology, MedEl, Riyadh, Saudi Arabia, 4Otology, King Saud Univ., King Abdullah Ear Specialist Ctr., Riyadh, Saudi Arabia.

Learner Objectives:
This study aimed to compare the predicted anatomy-based frequency allocation of cochlear implant electrodes with the default standard frequencies.
Introduction: Round window approaches are used to insert the cochlear implant electrode array into the scala tympani. The classic and most common approach to the round window is through posterior tympanotomy. There is a wide range of anatomical variations in the degree of intraoperative RWM visibility through posterior tympanotomy. Knowing about the alternative approaches to the RW besides the standard PT approach can help the surgeon in achieving the highest rates of RW insertion and get the benefits of RW insertion. Therefore, studying and reviewing the published works on the possible RW approaches would be helpful. However, to the best of our knowledge, there are no systematic reviews on this topic. In this study, we aimed to systematically review the different surgical approaches used to access the RW and explore associated intraoperative findings.

Methods: This review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Articles that described their surgical approach to the RW were included. The PubMed, Scopus, Web of Science, and Cochrane Library electronic databases were searched through June 2021. The study protocol was registered on PROSPERO (CRD42021226940).

Results: A total of 42 reports were included. The following approaches were documented: the standard facial recess, keyhole, retrofacial, modified supra-meatal, trans-aditus, combined posterior tympanotomy, and endomeatal, modified Veria, canal wall down approaches, and endoscopically assisted technique.

Conclusion: The findings of the present study suggest that there are numerous approaches to reaching the RW during CI. These approaches have been reported to be safe. If the visualization of the RW could not be achieved through the standard facial recess approach, the surgeon can try the other approaches. We recommend preoperative temporal bone CT assessment as certain parameters could provide some important information to predict the RW visualization and possible difficulties during the CI surgery.

Primary Author/Presenter: Isra Aljazeeri

Author Block: Isra A. Aljazeeri, Fellowship trained consultant otology neurotology1, Sajidah Alturaiki, MD1, Yassin Abdelsamad, PhD2, Farid Alzhrani, MD3, Abdulrahman Hagr, Professor3;1Otology, Ministry of health, Houfuf, Saudi Arabia, 2Otology, MedEl, Riyadh, Saudi Arabia, 3Otology, King Saud Univ., King Abdullah Ear Specialist Ctr., Riyadh, Saudi Arabia.

Learner Objectives:

This is a systematic review that illustrates all the possible approaches to the round window for cochlear implantation.
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: Basic Research
Poster Exhibit Number: 138  Student Poster Competition? Yes

Abstract Number: 52
Poster/Abstract Title: Effects of Cochlear Implant Processing on Emotional Responses to Nonspeech Sounds

Abstract Content:

Introduction: Over 740,000 people with moderate-to-profound sensorineural hearing loss worldwide live with a cochlear implant (CI), enabling them to hear sounds that they could not otherwise. Despite the ability of CIs to restore some hearing, many CI users still struggle to understand speech. Previous work has shown that hearing loss not only impacts speech understanding, but also decreases the range of emotional responses that an individual experiences while listening to sounds. Emotional responses to sound may be further compromised in CI users who rely on a spectrally degraded electric signal to perceive and process acoustic stimuli. Understanding how a spectrally degraded CI signal influences sound-induced emotion may facilitate the development of (re)habilitation strategies aimed at expanding the range of experienced emotion for CI users. In this study, we therefore seek to quantify the effects of CI processing on sound-induced emotional valence and arousal.

Methods: Thirty emotionally arousing nonspeech environmental sound stimuli from the International Affective Digitized Sounds database were filtered and processed through a vocoder to simulate electric hearing. To date, we have tested ten adults (age 15-47) with self-reported normal hearing. The stimuli were presented to the participants in random order in each of three conditions: 1) unprocessed, 2) 4-channel vocoded, and 3) 8-channel vocoded. Participants provided subjective ratings of the emotional valence and arousal of each stimulus using the standard 9-point Self-Assessment Manikin scale.

Results: Participants’ valence and arousal ratings were analyzed using repeated measures ANOVA. On average, vocoded stimuli were rated as more emotionally negative and less arousing than unprocessed stimuli. Moreover, 8-channel vocoded stimuli were rated as more emotionally positive and more arousing than 4-channel vocoded stimuli. The range of emotional valence responses was smaller for vocoded stimuli than for unprocessed stimuli, whereas the range of emotional arousal was larger for vocoded stimuli than for the unprocessed stimuli.

Conclusion: These preliminary results suggest that when environmental sounds are spectrally degraded in a manner that simulates electric hearing through a CI, they are perceived to be more negative and less arousing than natural, unprocessed stimuli. The range of sound-induced emotional arousal may therefore be altered in CI listeners. Subsequent analyses will investigate emotional responses to sound across a large cohort of listeners with normal hearing and in pediatric and adult CI users.

Primary Author/Presenter: Vaishnavi Moturi

Author Block: Vaishnavi Moturi, High School Student, Karlee R. Doak, BS, Braden M. Wiegand-Shahani, BS, Kelly N. Jahn, AuD, PhD; Speech, Language, and Hearing, Univ. of Texas at Dallas, Richardson, TX.

Learner Objectives:

Describe the effects of spectral degradation on emotional reactions to sound.

Explain the relevance of experienced emotion to quality of life and aural (re)habilitation.
Abstract Content:

Introduction: Pharmaceutical interventions hold a great potential for the preservation of residual hearing post-cochlear implantation. To achieve greater and consistent drug levels, intracochlear delivery is the key, but there are challenges in achieving high drug concentrations in all regions of the cochlea. The objective of this study was to evaluate the combined efficacy of a novel otoprotective drug (drug D) delivered through a cochlear catheter with a dexamethasone eluting electrode (Dexel) on residual hearing preservation in a preclinical animal model of cochlear implantation.

Methods: The animals were divided into 10 different groups: 1) Control; 2) animals implanted with a cochlear implant (CI); 3) animals implanted with a Dexel (Dexel); 4) Canula elution of artificial perilymph (Can + AP); 5) Canula elution of Ringer lactate (Can + Ringer); 6) Canula elution of Ringer lactate and implantation of animals (Can+ CI); 7) Canula elution of Ringer lactate solution and animals implanted with Dexel CI (Can + Dexel); 8) Canula elution of drug D at 5mM (Can D5); 9) Canula elution of drug D at 5mM and implantation of animals (Can D5+ CI); 10) Canula elution of drug D at 2mM and animals implanted with Dexel CI (Can D2+ Dexel). Hearing thresholds were determined in each group pre-operatively, day 7 and day 30 post-cochlear implantation, using auditory brainstem responses (ABRs). Animals were euthanized at day 30 post-cochlear implantation, and organ of Corti dissections were performed for each group. Immunostaining was performed to determine hair cell (HC) damage and oxidative stress markers.

Results: Hearing threshold shifts at day 7 and day 30 were significantly higher in all the implanted animals in all frequencies. Hearing threshold shifts of groups not treated with drug D (Can +AP Can +Ringer, Can + Dexel and Dexel) were lower than the standard CI group. HC viability was lower in the Can + AP/Ringer groups compared to control ears for basal outer hair cells (OHC). Dexel and Can + Dexel groups had OHC viability rates lower than control ear for basal basales and medial turns. HC viability was not statistically different to controls for Can D2+ Dexel and Can D5 groups. Oxidative stress presence was not statistically different to controls for Can D5, Can D5+CI and Can D2+ Dexel groups.

Conclusion: The cochlear catheter can be used efficiently for inner ear drug delivery during cochlear implantation for the preservation of residual hearing without having adverse effects on the cochlea. Drug D has a significant otoprotective effect, reaching the apical turns when delivered through the catheter. Canula delivery of drug D at 2mM and cochlear implantation with the dexamethasone eluting electrode have a synergistic effect allowing significant residual hearing preservation.

Primary Author/Presenter: Adrien Eshraghi

Author Block: Adrien A. Eshraghi, MD, MSC, FACS1, Maria-Pia Tuset, MD1, Jeenu Mittal, MSc1, Teresa Melchionna, PhD2, Carolyn Garnham, PhD2, Soeren Schilp, PhD2, Keelin McKenna, BS1, Rahul Mittal, PhD1;1Hearing Research and Cochlear Implant Laboratory, Department of Otolaryngology, Univ. of Miami Miller Sch. of Med., Miami, FL, 2MED-EL, Innsbruck, Austria.

Learner Objectives:
At the end of the session, participants will be able to learn about a novel way of inner ear drug delivery.
Parent Beliefs & Experiences with Genetic Testing for Children with Sensorineural Hearing Loss

Introduction: While the benefits of genetic testing have been documented; genetic testing has not become standard of care in otology/audiology practices. The reasons and barriers why remain largely unknown. The current study examined parents’ beliefs, knowledge, and experiences with genetic testing.

Methods: One hundred and forty-six parents were recruited from a comprehensive pediatric otology/audiology practice and social media groups for parents of children with hearing loss. The Parent Perception of Genetic Testing Questionnaire, which assesses parent perceptions, decisions, and satisfaction with genetic testing was completed electronically. The majority of parents were mothers (91.8%), between the ages of 30-49 years (49.3%), and identified as non-Hispanic (76.6%) and White (95.2%). Children had a mean age of 6.96 (SD=6.18) years and 45.5% were female. The majority of children had congenital hearing loss (63.1%). Most of the sample did not know etiology (47.3%), followed by probably genetic cause (40.4%), infectious diseases (5.5%), and other (6.8%). Twenty-five percent of the children wore cochlear implants, 66.4% hearing aids, 5.5% bone conduction device, and 6.8% were unaided.

Results: Approximately 47.6% of the children in our sample underwent genetic testing. For those that did not pursue testing, 20% were not aware and 40% were aware, but not interested. Barriers self-reported by families that did not pursue testing included trouble with insurance (40%), difficulty scheduling (10%), concerns with blood draw (10%), and mistrust in doctors (10%). For those who did pursue testing, 11.6% did not receive results. Less than half of families reported using the results to make decisions about family planning (39.7%), most shared results with relatives (90%), and were willing to share with their child (81.1%). Reasons for sharing results included: awareness, family concern, and family planning. Reasons for not sharing included test was inconclusive, lack of family interest, and privacy. In addition, over half reported they did not receive counseling before (55.1%) and only 41.7% reported receiving counseling after the testing. When receiving results, parents reported being confused (18.3% Very Confused; 28.3% Somewhat Confused; 20% A Little Confused). More importantly, less than half of parents (43.4%) remembered what they were told about the mode of inheritance and 40% reported a significant delay in obtaining results, describing less than optimal satisfaction with the care they received following testing.

Conclusion: Parents of children with hearing loss reported being open to genetic testing to aid in their decision making and treatment options. However, there continues to be significant barriers to obtaining genetic testing as well as counseling post-testing. Future research is warranted to help ameliorate these barriers and improve access to genetic testing and counseling for patients with hearing loss.
contrast rates of counseling received before and after genetic testing process.
The need to accelerate scientific and technology based research for cochlear implant users and systems continues to grow, yet progress is at times limited by the ability of non-commercial teams to efficiently assess innovative scientific principles and technology in order to transition these advancements to industry. The COVID-19 pandemic has further reduced the ability for human subject testing in laboratory conditions due to IRB constraints, and testing in naturalistic settings continues to be difficult. As such, there is a critical need for conducting listener experiments remotely versus traditional in-person methods due to social distancing measures enforced by COVID-19 pandemic. CCI-MOBILE, developed by CRSS-CILab-UTDallas over the past ten years is a hardware research platform created to support the Cochlear Implant research community, facilitating the development of new strategies & algorithms for improving sound quality and scientific investigation for CI users/systems. In this study, CCI-CLOUD, a virtual platform, is proposed and developed to expand the functionality of CCI-MOBILE to allow for both subject testing and scientific studies to be performed remotely. The CCI-CLOUD portal is established with three support categories: (i) Remote Desktop: with direct connect support for CI user remote experimentation; (ii) Cloud Data Storage: for data sharing among researchers & subjects; (iii) Online Web App: serves as a portal which connects CI subjects with the CI research community. Three multimodal sound experiments are considered in this study as a demonstration of the virtual experimental framework including speech recognition, speaker identification, and sound type classification for both CI and normal hearing (NH) users. Experimental evaluation is performed for both In-Lab and Remote/Online scenarios to benchmark experimental protocols and infrastructure validity for CI/NH subjects. Results on consistency between the two modalities are also discussed. This study shows the ability to create an online portal that supports hardware/firmware and experimental protocols to accelerate CI subject testing, thereby reducing both time, costs, and increasing CI test validity for the community.
Introduction: In this study, we analyze the phonological processes produced by Spanish- and English-speaking bilingual children with hearing loss who use cochlear implants and their peers with normal hearing by specifically focusing on the effects of hearing loss and the use of cochlear implants, language, and typicality of phonological patterns. Methods: Forty bilingual Spanish- and English-speaking children (20 cochlear implant users and 20 with normal hearing) between the ages of 5;3 and 7;9 (years; months) participated in the study. Cochlear implant users received their implants before they turned 3 years old and had at least 3 years of implant experience. Items from a single-word elicitation task were selected for the analyses to test the effects of hearing status (cochlear implant users versus their age-matched peers with normal hearing), language (Spanish versus English), and phonological process type (typical versus atypical process). A repeated measures analysis of variance was conducted with hearing status as the between-subjects variable and language and typicality of processes as within-subjects variables. The dependent variable was percentage of occurrence of phonological processes. Results: There was a statistically significant main effect of hearing status \( [F (1, 38) = 61.73 \text{ at } p < 0.001 \text{ with an effect size of partial } \eta^2 = 0.62] \). There was also a statistically significant main effect for typical versus atypical processes \( (F (1, 38) = 131.01 \text{ at } p < 0.001 \text{ with an effect size of partial } \eta^2 = 0.78) \). That is to say, there was a difference in the occurrence of phonological processes depending on whether they were typical or atypical. No main effect for language was found \( [F (1, 38) = 0.35 \text{ at } p = 0.556 \text{ with an effect size of partial } \eta^2 = 0.09] \). Typicality of processes did interact with hearing status in that children who use cochlear implants displayed a higher proportion of atypical phonological processes than their peers with normal hearing \( (F (1, 38) = 52.29 \text{ at } p < 0.001 \text{ with an effect size of partial } \eta^2 = 0.58) \). Conclusion: When it comes to the occurrence of phonological process in the productions of bilingual children with hearing loss who use cochlear implants, their patterns differ from those of their peers who are bilingual and have normal hearing. There is also a difference between the occurrence of typical versus atypical phonological processes in children who are bilingual who use cochlear implants in contrast with their peers with normal hearing. However, there does not appear to be a difference in the occurrence of phonological processes between the Spanish and English productions of bilingual children. Furthermore, the existence of an interaction effect between hearing status and typicality of phonological processes indicates that bilingual children with hearing loss who use cochlear implants display disproportionally more atypical processes than their bilingual peers with normal hearing. Our findings add to a growing body of work on the speech patterns of bilingual children with hearing loss by finding an interplay between spoken bilingualism and acquiring two languages with a diminished signal provided by cochlear implants.

Primary Author/Presenter: Ferenc Bunta

Author Block: Ferenc Bunta, PhD1, Claudia Ramirez, Undergraduate Student2, Ross Tonini, AuD2;1Communication Sciences and Disorders, Univ. of Houston, Manvel, TX, 2Communication Sciences and Disorders, Univ. of Houston, Houston, TX.
Learner Objectives:

• After attending the presentation, participants will be able to describe how select speech and language patterns of bilingual children with hearing loss who use cochlear implants compare to those of their bilingual peers with normal hearing.

• Having attended the presentation, participants will be able to discuss issues involved with assessing speech and language patterns of young bilingual children with hearing loss who use cochlear implants pertaining to how learning two languages and having
Audiology Practice Sustainability: Can an Efficient Cochlear Implant Habilitation Model Be Economically Viable and Sustain New Patient Growth?

Abstract Content:

Introduction: Audiologists play an integral role in the habilitation of patients following cochlear implantation through device programming and patient counseling. There is, however, variability in the appointment cadence, time block and types of service audiologists provide. Recipients have multiple appointments in the first-year post-implantation then at least once annually, leading to constant growth in the time allocated to managing existing recipients, often at the expense of time spent evaluating new candidates. As evidence evolves to support achieving the desired outcomes through a more streamlined care model, there is considerable opportunity to improve patients’ access to implant audiologists and for audiologists to shift resources to candidacy evaluations. As audiologists integrate changes intended to drive efficiencies, consideration should be given to the impact of those changes on quality and total cost of care. This presentation will focus on the relationship between audiology services, billing codes and revenue with emphasis on concurrently managing program efficiency, and both clinical and reimbursement outcomes. Methods: A retrospective analysis of cochlear implant (CI) recipient claims was performed at two CI centers to determine the extent of denials for services commonly performed together to determine payer adherence to National Correct Coding Initiative (NCCI) criteria and financial impact of payer payment policies. Results: Over a 12-month period, 43% of recipient encounters at two CI centers in Texas were under reimbursed by an average of $90 per encounter. Denials varied among specific payers between 0-100%. Conclusion: Effectively managing reimbursement outcomes in what is often viewed as a challenging reimbursement space requires an acute understanding of reimbursement rules, close monitoring of reimbursement outcomes and a willingness to engage with payers to drive adherence to appropriate reimbursement. Indeed, members of the profession must be prepared to convey the clinical and economic value of their services to payers if the aim is to support the growing base of patients who need CIs. As clinical delivery models evolve, it is imperative that CI practices measure and manage payer performance in a way that supports both sustainability and patient satisfaction.

Primary Author/Presenter: Arun Joshi

Author Block: Arun Joshi, Doctor of Audiology1, Jim Byrd, Bachelor of Science in Business Administration2;1Cochlear Hearing Ctr., Bellaire, TX, 2Cochlear Americas, Lone Tree, CO.

Learner Objectives:

describe the efficient delivery of habilitative care models and services with reimbursement outcomes and the overall sustainability of CI specific audiology services.

identify methods to engage with payers to appeal inappropriate bundling denials and educate payers on the application of National Correct Coding Initiative (NCCI) edits and modifier overrides to support the efficient delivery of habilitative services
**CI2023 Dallas: Cochlear Implants in Children and Adults**

**Poster Exhibit Abstract**

**Poster Category:** Economics, Public Policy, and Practice Management

**Poster Exhibit Number:** 118  **Student Poster Competition?**

**Abstract Number:** 73

**Poster/Abstract Title:** Comparative effectiveness and cost-effectiveness of the Cochlear(TM) Osia 2 and Cochlear (TM) Baha Atract systems in patients with conductive or mixed hearing loss or single-sided deafness: trial-based analysis and probabilistic economic model from a pri

**Abstract Content:**

**Introduction:** Bone conduction implant (BCI) devices are a well-established treatment option for patients with conductive or mixed hearing loss (CMHL), or single-sided deafness (SSD). The CochlearTM Osia 2 (Osia) System is an active transcutaneous osseointegrated BCI utilising piezoelectric transducer technology and a fitting range ≤55dB sensorineural hearing level. The Osia transducer technology differs from other transcutaneous BCI, including the CochlearTM Baha Atract system. There are no large scale randomised controlled trials (RCTs) comparing BCI systems. The Osia system has been studied using accepted methodology where patients serve as their own controls in two large, prospective, multicentre clinical studies (Mylanus 2020, Briggs 2022). These studies concluded Osia is more effective than both the unaided hearing situation and a non-implanted bone conduction system (Baha on Softband, with similar power level).

**Methods:** A systematic literature search was conducted to confirm the absence of relevant RCTs and identify publications suitable to inform indirect treatment comparisons (ITC) of Osia with Baha Atract. In addition to the two pivotal Osia studies, one study with comparable design and endpoints investigating Baha Atract was identified (den Besten 2019, Kruyt 2020). Patient characteristics were similar across all studies. Data from the Osia studies were synthesised with a random effects inverse-variance weighted meta-analysis. ITCs were conducted for the objective audiological measures pure tone average (PTA), speech discrimination in quiet and noise, patient reported outcomes (PROs) and utility measures via unaided hearing as the common arm. A Markov economic model was developed to estimate the cost-utility of Osia compared to Baha Atract in the Australian private insurance setting. A 10-year time horizon and 5% annual discounting of costs and outcomes was applied.

**Results:** A robust ITC comparing Osia with the Baha Atract system demonstrated: 1) Osia is more effective than Baha Atract: with statistically significant and clinically relevant improvements across all hearing outcomes; 2) Osia has at least an equivalent safety profile to Baha Atract, with advantages in reduced skin irritation and pain secondary to pressure from magnet retention; 3) Osia has advantages in PROs and a recognised clinically meaningful (Drummond 2001) incremental utility (HUI 3) gain of 0.03. The Markov model demonstrated that the Osia System is cost-effective compared to Baha Atract with a favourable incremental cost-effectiveness ratio within the Australian health care system.

**Conclusion:** An ITC, utilising audiological, PRO and utility data from large clinical studies, demonstrated that the Osia System is more effective than Baha Atract, resulting in improved hearing outcomes for CMHL and SSD patients. Subsidy of the Osia System represents cost-effective use of private insurance funds as demonstrated in a cost-utility analysis versus Baha Atract.

**Primary Author/Presenter:** Dell Kingsford Smith

**Author Block:** Dell Kingsford Smith, PhD1, Matthias Brunner, PhD2, Robert J. Briggs, MD3, Manjula Schou, PhD4; 1Medical Affairs and Market Access, Cochlear Limited, Sydney, Australia, 2Health Economics, Cochlear Asia Pacific, Sydney, Australia, 3Department of Surgery, Otolaryngology, The Univ. of Melbourne, Melbourne, Australia, 4Biostatistics, Cochlear Global Clinical, Cochlear Limited, Sydney, Australia.
Learner Objectives:

At the end of the session, participants will be able to define the cost-effectiveness of active, transcutaneous bone conduction hearing systems in comparison to passive, transcutaneous systems.
Abstract Content:
Introducion: The traditional cochlear implant activation process occurs anywhere from two to four weeks following surgery. During this time period, patients have reduced access to sound, and at times may have no functional access to sound until activation. Over the last few years, our clinic has introduced the option of activating the device as early as the same day as surgery. As a destination medical center, same-day or next-day activation can be beneficial logistically for patients that come from afar. Local patients can similarly share a benefit from early activation providing access to sound sooner. This study looks beyond the logistical benefits for the patient, aiming to compare outcomes and objective measures of same/next day activation compared to later activation dates. Objective measurements that were analyzed include magnet strength needs, speech perception scores, impedances, and charge levels among each group. We hypothesize that the time of cochlear implant activation post-surgery does not affect performance of speech perception, impedance measurements, magnet strengths or electrical stimulation levels. Methods: This is a retrospective study looking at 152 patients with an average age of 61 years who underwent cochlear implantation in 2020. Four subgroups of activation time period were examined: same day/next day, within one week, between one and two weeks, and after two weeks. We looked at data taken from the pre-operative appointment, 1-, 3-, 6-, and 12-month post-operative appointment to determine the correlation between time of activation and five systemic variables (magnet strength, speech performance, charge levels, data logging and impedance measures). Results: When looking at CNC and AzBio performance between same day/next day activation to each subgroup, there was not a significant difference at preoperative evaluation, 3-month evaluation, or 12-month evaluation. Comparison of magnet strength at initial activation, 1-month, 3-month, 6-month, and 12-month evaluations revealed no significant difference between same day/next day activation to the other subgroups. Analysis of impedance measures of each electrode at initial activation was lower for the same day/next day group compared to the other groups. We speculate that this increase in impedance for groups activating later is due to the possibility of tissue growth around electrodes. Following a period of stimulation, impedance levels reduced in devices that were activated at a later day, more so matching the same/next day group by one month post activation. Conclusion: Early device activation does not elicit negative effects on clinical parameters of patient outcome. Non-audiological advantages of same day/next day activation can lead to an overall improved patient experience. Future evaluation of patient experience (e.g., potential time and cost savings, satisfaction) is necessary to further elucidate potential benefits or limitations of this strategy.

Primary Author/Presenter: Kayli Silverstein
Author Block: Kayli N. Silverstein, Au.D 4th year student1, Madison K. Graham, Au.D., M.A.1, Matthew L. Carlson, M.D.2, Collin L. W. Driscoll, M.D.2, Brian A. Neff, M.D.2, Melissa D. De Jong, Au.D.1, Aniket A. Saoji, Ph.D.1;1Audiology, Mayo Clinic, Rochester, MN, 2Otorhinolaryngology, Mayo Clinic, Rochester, MN.

Learner Objectives:
CI2023 Dallas: Cochlear Implants in Children and Adults

At the end of the session, participants will be able to compare hearing outcomes between cochlear implant patients who receive early device activation as compared to those with standard device activation.
Hearing Together

Introduction: Teamwork within the medical field is integral to facilitating patient success and satisfaction. Under the strong direction of a neuro-otologist, a team of audiologists and a speech language pathologist/auditory-verbal therapist can work collaboratively to ensure all professionals feel supported, have regular access to feedback and ideas, and work together to avoid frustrations and eventual burnout. By maintaining an open channel of communication and a well-established team-based process, patients primarily cared for by one clinician reap the benefits of care provided by a sizable, multidisciplinary team.

Methods: At regular team meetings, the needs, goals, and concerns of each new patient are discussed. The physician delineates anatomical and physiological concerns, as well as any comorbid considerations. The audiologists share patient sound perceptions, technological needs, and mapping parameter specifications. The speech language pathologist reports a patient's progress and limitations as related to their access to sound and developmental norms. Within this open forum, clinicians are easily able to problem-solve on the spot, leaving each meeting with new ideas to bring into their clinical sessions. Discussion of challenging cases provides an opportunity for clinicians to lean on one another, and combine resources to find unique solutions. During pre and intra operative testing, audiology provides real time feedback to the surgeon allowing for immediate integration of imaging and electro-physiological measures. Post-operatively, the speech language pathologist sees every patient for several visits to establish a baseline, provide family centered care, and formulate a home-practice plan. For the pediatric population, the speech language pathologist will participate in audiological sessions as well. This allows for carry-over from the frequent speech therapy sessions to audiological testing and increases the child’s comfort in the otherwise stressful and unfamiliar audiometric booth. The audiologists and speech language pathologist share data continuously. Input from the speech language pathologist provides information regarding patients’ communication skills and their access to speech and sound during structured and conversational listening tasks.

Results: Each clinician supports appointment attendance with the surgeon, audiology, and speech-language pathology. With patients frequenting the Center and seen by a variety of specialists, patient performance does not rely on one professional in isolation and allows both the patient and the professional to feel supported, with access to many resources. Additionally, this team approach has promoted a high morale and longevity among clinicians. This process is illustrated via two complex patient cases in which all team members remain actively involved. Patient testimonials included.

Conclusion: As professionals, consistent and transparent communication prevents clinicians from bearing the weight of a struggling patient in isolation and provides the clinician with the shared knowledge base of a complete, multi-disciplinary team. Patients benefit from this shared knowledge and enjoy the comfort of knowing that all of the members of their care team are up to date with their successes and their struggles in order to best meet their hearing needs.

Primary Author/Presenter: Michelle Albera

Learner Objectives:

Identify qualities needed for effective teamwork

Describe how to implement an interdisciplinary approach in order to best meet patient needs
**Abstract Content:**

Introduction: Earlier cochlear implantation in children with bilateral severe to profound sensorineural hearing loss is associated with improved language outcomes. More work is necessary to identify patients at risk for delayed cochlear implantation and understand targets for interventions to improve cochlear implantation rates in children. The objective of this study was to characterize the demographics of children receiving cochlear implantations, identify factors associated with delayed implantations, and trend these factors over time.

Methods: The Healthcare Cost and Utilization Project California State Ambulatory Surgery Database for calendar years 2018 to 2020 were obtained. Children age ≤5 years old undergoing cochlear implantation were identified and included in the final cohort. The population-controlled number of cochlear implantations was calculated and stratified by race and insurance. Early implantation was defined as implantation at age ≤2 years old. A mixed effects logistic regression model was generated to identify factors associated with early implantation and how that association changed from 2018 to 2020.

Results: The final cohort included 467 children. The number of implantations increased from 141 to 175 implants from 2018 to 2020 (24.1% increase); 229 (49.0%) children were implanted at ≤2 years of age. Medicaid insurance was associated with decreased odds of early implantation (OR 0.18 [95% CI 0.15-0.23], p<0.001); this association with Medicaid insurance was significant when stratified across all racial groups. The percentage of children with Medicaid who were implanted ≤2 years old increased from 20.9% to 62.0% from 2018 to 2020.

Conclusion: Among children in California, socioeconomic factors, in particular public insurance, are associated with differences in access to early cochlear implantation. These disparities improved significantly from 2018 to 2020. Further investigation into changes and initiatives in California during this time frame may aid in directing national efforts to improve pediatric cochlear implantation access.

**Primary Author/Presenter:** Rance Fujiwara

**Author Block:** Rance J. Fujiwara, MD MBA1, Emily C. Wong, MD1, Gail Ishiyama, MD2, Akira Ishiyama, MD1;1Head and Neck Surgery, David Geffen Sch. of Med. at UCLA, Los Angeles, CA, 2Neurology, David Geffen Sch. of Med. at UCLA, Los Angeles, CA.

**Learner Objectives:**

- Describe variations and trends in pediatric cochlear implantations over time
- Identify risk factors for delays in pediatric cochlear implantation
Abstract:
Introduction: The need for cochlear implantations in Germany is estimated at around 10,000 per year. However, implantations are currently only about 2000 per year. This supply gap results in the need for further supply capacities outside of tertiary referral centers.

Methods: We report on the activities to implement a clinic culture to start an implantation program. Particular focus is placed on the process of setting up the supply structure at the level of personnel capacities and equipment in order to achieve good process quality and thus a safe implantation structure.

Results: After a period of less than 3 months, the implantation program was started. After initially a few implantations, the number was successively increased and the supply structure for the patients was established.

Conclusion: Cochlear implantations outside of tertiary referral centers is necessary to ensure patient care. If the necessary care structures are set up, an implantation program can also be implemented in a secondary care center and thus develop into a tertiary care center. In Germany however, compliance with the regulatory framework is also important.

Primary Author/Presenter: Magnus Teschner

Author Block: Magnus J. Teschner, MD, PhD, MBA
Department of Otolaryngology, Stiftungsklinikum Proselis gGmbH, Prosper-Hosp. Recklinghausen, Recklinghausen, Germany.

Learner Objectives:

- implement a cochlear implant program in a secondary care center.
- plan a structure necessary for cochlea implantation.
**Poster/Abstract Title:** Targeted screening for Congenital Cytomegalovirus in Chile: a way to expand access to cochlear implants.

**Abstract Content:**

Introduction: Chile has a good hearing health program: there is universal coverage for hearing aids (HAs) and cochlear implants (CIs) for all children diagnosed with hearing loss (HL) detected before the age of 4. However, this benefit is lost if the diagnosis is late or is a late-onset HL. On the other hand, Chile does not have universal hearing screening for newborns (NB), neither screening for Congenital Cytomegalovirus infection (cCMV), a cause of late-onset hearing loss. cCMV is the most frequent cause of congenital infection, 90% of affected NB are asymptomatic at birth and 6-15% will develop long term sequelae. It is the main etiology of non-genetic sensorineural hearing loss. As a first step, the Chilean Society of Infectology, through its Neonatal Infections Committee in conjunction with the Chilean Society of Obstetrics and Gynecology and the support of the civil society through the SotopCMV NGO, propose a multidisciplinary guideline for the Diagnosis and Management of Cytomegalovirus Infection in Pregnancy and Newborn. They recommend at least targeted screening in the high-risk population. Aims: To describe the prevalence of cCMV in Chilean high-risk NB as a first step to promote cCMV NB screening and to describe the outcomes of the guideline. Methods: Cohort prospective study, including inpatient NB with one or more of the following criteria: birth weight < 1,500 g, < 32 weeks gestational age (GA), severe small for gestational age (SGA), suspected congenital infection or “refer” in newborn hearing test, and infants born to HIV-infected mothers. Urine CMV polymerase chain reaction was performed within 21 days of life. Results: 193 NB were enrolled. Global cCMV prevalence were 2.6% (n: 5) and by risk group: one third (n: 1) in NB with suspected congenital infection, 8.3% in NB with “refer” result in hearing test, 4.9% in infants born to HIV-infected mothers, 3.3% in severe SGA and 1.7% in < 1,500 g, none with significant association. Only one symptomatic cCMV was detected who died in neonatal period and the remaining (asymptomatic) cCMV patients have normal hearing follow-up at 12 months of age. Conclusion: cCMV prevalence was comparable to international reports. We recommend cCMV screening, at least in risk groups, being ideal the universal screening. This would allow timely treatment and active follow-up and be able to justify the coverage of HAs and CIs even if the diagnosis is later than 4 years old in this group of children.

**Primary Author/Presenter:** Carolina Der

**Author Block:** Giannina Izquierdo, MD1, Angela Chuang, MD2, Carolina Der, MD, PhD3;1Complejo Asistencial Barros Luco Trudeau - Univ. de Chile - Hosp. Exequiel González Cortés, Santiago, Chile, 2Complejo Asistencial Barros Luco Trudeau, Santiago, Chile, 3Dr Luis Calvo Mackenna Hosp. - Univ. del Desarrollo, Santiago, Chile.

**Learner Objectives:**

Describe the prevalence of CMV in Chilean high-risk NB as a first step to promote cCMV NB screening as a way to expand access to cochlear implants.
CI2023 Dallas: Cochlear Implants in Children and Adults

Describe the chilean multidisciplinary consensus for the Diagnosis and Management of Cytomegalovirus Infection in Pregnancy and Newborn.
Abstract Content:

Introduction: After identification for eligibility, the cochlear implantation (CI) evaluation and implantation pathway require patients to attend several outpatient appointments, including preoperative evaluation by audiologists, imaging, device selection, anesthesia, surgeons, and the surgery itself. Consequently, patients frequently experience significant delays between their initial visit and implantation. These delays can be compounded in cochlear implant teams across multiple institutions. In recent years there has been considerable effort to streamline this process using process maps. However, these studies have only occurred at large academic centers where all the providers and resources are within a single institution. The objective of this study was to demonstrate the utility of process mapping to develop a multi-institutional CI delivery model that optimizes patient outcomes and satisfaction by decreasing wait times and travel.

Methods: Process mapping was used to identify the current cochlear implant delivery model across multiple institutions. The process was analyzed for bottlenecks and optimized into a post-analysis pathway designed to improve efficiency and patient access to cochlear implantation. A retrospective chart review was performed of patients undergoing CI in 2022 before and after process optimization. Wait times between key events were determined from timestamps in the electronic medical record, while activity times were estimated by personnel responsible for the task. The total time from referral to implantation was recorded in both states. Statistical analyses were performed with SPSS.

Results: Data from 15 adults that underwent CI were used to develop a process map of the initial operational state from referral to surgery. Prolonged wait times were associated with appointment scheduling, insurance approval, device ordering and shipment, and surgical scheduling. Time to implantation was analyzed in 15 patients after process optimization. The streamlined care pipeline allowed for improved efficiency that lowered overall time to implantation and increased patient satisfaction.

Conclusion: This analysis and pilot program demonstrates the feasibility and benefits of streamlining cochlear implant pathways across multiple institutions. This study used a patient-centered design process to identify and address opportunities for meaningful care improvement to maximize patient value. The new CI pathway delivers highly coordinated care, early patient access to information and providers, and a newly established implant inventory without affecting patient-provider interaction or burdening provider logistics.

Primary Author/Presenter: Camron Davies

Author Block: Camron Davies, MD1, Joseph Berry, B.S.1, Dhruv Kothari, B.S.1, Celine Richard, M.D.1, Jordan A. Coffelt, AuD2, Sarah E. Warren, Au.D., Ph.D.2, Robert Yawn, M.D.1; 1Otolaryngology - Head and Neck Surgery, The Univ. of Tennessee Hlth. Sci. Ctr., Memphis, TN, 2Memphis Speech and Hearing Center, The Univ. of Memphis, Memphis, TN.

Learner Objectives:
- Create a process map that effectively identifies key areas in a multi-institutional cochlear implant pipeline
CI2023 Dallas: Cochlear Implants in Children and Adults

- Identify and analyze areas that can be optimized to improve efficiency and patient satisfaction.
Connecting with Families & Learning their True Needs: Implementation of a Virtual Team-based Model

Abstract Content:

Introduction: Multi-disciplinary care is the gold standard model for high quality, comprehensive pediatric clinical care. Children undergoing the cochlear implant (CI) candidacy process must attend numerous appointments to evaluate for candidacy, to discuss realistic expectations, and to counsel families on the rehabilitation process and psychosocial impact of pediatric hearing loss. This study evaluated the satisfaction and efficacy of integrating a virtual team-based model for two subgroups of patients: 1) children undergoing the CI evaluation process and 2) established pediatric CI recipients.

Methods: Forty-five children and families were enrolled. Fifteen were in the CI evaluation arm and 30 were in the established CI recipient arm. All underwent individual virtual consultations with each specialty, including remote CI programming, AVT session, psychology consultation, and educational consultation, and a team-based virtual session. For subjects in the CI evaluation arm, a team meeting occurred pre-implantation and 6 months post-op. Survey data was collected to track auditory milestones, family psychosocial functioning, feasibility, and family satisfaction with the remote team-based care.

Results: While this study is ongoing, preliminary data reveals this service delivery model is both feasible and effective in navigating pediatric CI care, particularly for children undergoing CI evaluation. Additionally, all families reported a high level of satisfaction. Survey data results will be discussed for tracking auditory milestones, family psychosocial functioning, feasibility, and family satisfaction with the remote team-based care. Anecdotally, this project highlights many important aspects of CI care for children undergoing CI evaluation. Families expressed a clearer understanding of expectations and are relieved to have all providers on the same page regarding the treatment plan. The team meeting allowed families to virtually connect with our multidisciplinary team to understand the audiological, speech and language, psychosocial, and educational impacts of hearing loss. Most surprisingly, for the established CI recipients this team meeting revealed that even our “audiological star performers” (where no prior concern was raised) often need continued support for education, the child’s social development, or acceptance of hearing loss. Check-ins with families are crucial to assess whether support continues to be needed.

Conclusion: This study highlights the imperative need to incorporate a team-based model for all pediatric CI patients - whether new or established. This multi-disciplinary approach emphasizes the importance of the “whole child” and family system and allows providers to connect with families to better understand their needs. Utilization of this innovative model allows CI programs to monitor their patients efficiently and provide targeted interventions as needed, which ultimately will lead to improved outcomes for this population.

Primary Author/Presenter: Chrisanda Sanchez

Author Block: Chrisanda Sanchez, AuD, Meredith Holcomb, AuD, Jordan McNair, AuD, Domitille Lochet, SLPD, Alexandria Mestres, BAEd, Jennifer Coto, PhD, Ivette Cejas, PhD; Otolaryngology, Univ. of Miami, Miami, FL.

Learner Objectives:
Describe the benefits of incorporating a virtual multidisciplinary team meeting for CI recipients and patients undergoing the CI evaluation process.
ACIA 2023 ABSTRACT
Do Aminoglycosides Affect Preterm Hearing? Vivian F. Kaul, MD; Hajera Afreen, BS; Maxwell Bergman, MD; Oliver F. Adunka, MD MBA

Introduction: As providers, we are still unsure of how best to counsel the risks and benefits of aminoglycoside use during the preterm infant intensive care unit. While the World Health Organization recommends it for serious infections in preterm infants, the Joint Commission on Infant Hearing (JCIH), has put out statements dating back to 1990 which have linked aminoglycoside use with hearing loss but none on its risk/benefit analysis for treating infection while weighing it against hearing loss. At the end of the session, participants will be able to distill with greater certainty the risks and benefits of aminoglycosides in preterm infants, specifically how it affects their hearing.

Methods: Pubmed articles from 1978-2022 were queried, with search terms included “aminoglycoside”, “hearing”, “duration”, “neonate”, “NICU”, “gentamicin”, “tobramycin”, and “kanamycin”. Of the 458 articles, abstracts were excluded if there were redundant, had no available text, were not in English, were based off animal models, or studied the adult population. Study characteristics and outcome data were extracted independently in duplicate, and a consensus was reached on all items. The following outcomes were analyzed if available: (1) effect of gestational age/weight; (2) dosing and duration of aminoglycosides (3) other confounding factors (medications/ventilator use etc) (4) ototoxicity based on pure tone audiometry (PTA), brainstem auditory evoked responses (ABR), or otoacoustic emissions (OAE) for neonates/infants. Ototoxicity outcomes were evaluated at varying timepoints during the therapy.

Results: 37 articles met criteria and were reviewed. There were 17 prospective cohort, 10 retrospective, 8 case-control, 1 cross sectional and 1 randomized control study. 17 articles (45.9%) concluded that aminoglycosides were significant in affecting the hearing status of neonates. Most articles were studying gentamycin (n=19, 40%). Level I evidence from the randomized controlled study, concluded that compared to ceftriaxone, gentamicin and benzylpenicillin did not increase the risk of hearing loss. Other significant findings included hearing loss being affected by furosemide, birthweight < 1500 g, mechanical ventilation, ICU stay duration, and vancomycin exposure. There is a trend towards prolonged aminoglycoside duration (>5 days) resulting in worsening hearing loss.

Conclusion: While aminoglycosides are effective at treating life-threatening sepsis and infection in the preterm infant, they can cause a permanent deficit of sensorineural hearing loss. The current WHO recommendation should be amended to limit the aminoglycoside dose to < 5 days if possible to lessen the risk burden of permanent hearing loss.

Primary Author/Presenter: Hajera Afreen

Author Block: Vivian F. Kaul, MD, Hajera Afreen, Bachelor of Science, Maxwell Bergman, MD, Oliver F. Adunka, MD, MBA; Otolaryngology, The Ohio State Univ., Columbus, OH.

Learner Objectives:
At the end of the session, participants will be able to distill with greater certainty the risks and benefits of aminoglycosides in preterm infants, specifically how it affects their hearing.
Abstract Content:

Introduction: Cochlear implant candidates are required to navigate through multiple steps involving interdisciplinary departments including but not limited to otology, audiology, speech pathology, social work, neurology, radiology, laboratory, surgery department and primary care physicians for surgical clearance. There are multiple steps to determining that can be overwhelming for adult patients and parents of pediatric patients. How do we streamline this process to provide patients and their families with an efficient and quality service to help them reach their hearing goals? Helping patient’s efficiently navigate through the program allows the program to grow and help more patients in need.

Methods: Cochlear implant evaluation process involves multiple discipline visits. Patients were expected to schedule and coordinate these individual evaluations to complete the evaluation process and it was taking 5-6 months to complete. Our department was struggling to obtain all evaluations needed in order to submit a complete packet to request cochlear implant approval. We realized if we have a gate-keeper that can track patient progress, it would be an invaluable asset for our program. Thankfully, the Cochlear Implant Coordinator position was approved. Our CI Coordinator helps a candidate’s navigate through their candidacy process while working with multiple departments. Their responsibilities including helping patient’s coordinate their appointments, collects necessary documentation and works with patient’s insurance for pre-approvals. She is a point of contact for the patient to help them reach their goal.

Results: Our cochlear implant coordinator managed each patient and has been able to reduce travel time and combine appointments on the same day. Our CI coordinator is able to track each patient personally and provide better guidance for our patients. Since implementing the changes, we have streamlined our program to help patients through their evaluation to implantation within an average of 3 months.

Conclusion: A CI Coordinator can help a Cochlear Implant Program streamline their processes and provide candidates with the support they need to navigate through a hospital settings. Our CI Coordinator has helped grow the CI Program by reducing the time it takes from candidacy to implantation for each patient.

Primary Author/Presenter: Arineh Khachatoorians

Author Block: Arineh Khachatoorians, AuD, Wendy Ayala, Medical Assistant; Audiology, UCLA, Los Angeles, CA.

Learner Objectives:

Describe value added in having a cochlear implant coordinator

Identify three ways a Cochlear implant coordinator will benefit their cochlear implant program
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: Miscellaneous
Poster Exhibit Number: 143

Abstract Number: 99
Poster/Abstract Title: Cochlear implantation in post-lingual adults. A 25-year experience at King Abdullah Ear Specialist Center, Riyadh, Saudi Arabia

Abstract Content:
Introduction: Hearing loss is one of the common disabilities in adults. Unlike routine ophthalmologic examinations, screening for hearing loss among adults may not be performed regularly during primary care visits. This has resulted in lower rates of referrals for the in-depth testing of these patients. The other problem of hearing loss in post-lingual adults is poor follow-up rates and poor adherence to recommended treatment after screening. This means that the burden of hearing disabilities among adults is higher than reported. A limited number of studies have examined CI in post-lingual adults with a large number of participants. Further, the literature review also showed a lack of related reported practice in Arabic countries. Methods: This study was a retrospective, descriptive chart review of post-lingual adults, aged ≥18 years, implanted at King Abdullah Ear Specialist Center (KAESC), Kingdom of Saudi Arabia (KSA), between September 1994 and March 2020. The study included 176 cochlear implantations performed in 144 patients. Data retrieval was done from medical records. Results: This study included 176 CIs performed in 144 patients. The male:female ratio was 1.61:1. The mean age at the time of CI was 35±15 years. The average age of hearing deprivation before CI was 15±11 years (1-56 years). More than half of the patients (n=105, 59%) used hearing aids before the CI, for a mean duration of 10.5±9.5 years (1-30 years). The preoperative pure tone was 102±15 dB, which improved significantly after CI to 29±10 dB (p<0.001 with a mean difference of 76.52 and 95% confidence interval: 72.14-80.98). The SRT also improved from 76±21 dB to 29±12 dB (p<0.001, with a mean difference of 48.79% and 95% confidence interval: 40.26-57.32). The WRS increased significantly from 6.94±16.71 to 61.43±23.13 (p<0.001; mean difference 54.48; 95% confidence interval: 47.41-61.56) Conclusion: CI in our institute was found to be safe and effective, with significant improvements in auditory performance. The study population was noted to experience a delay in management. The reason for the long gap between the onset of hearing loss and CI needs to be investigated. Nevertheless, it is speculated that the delay could be because of a defect in the referral process or a lack of knowledge and motivation in patients, or their fears and concerns regarding CI. Further investigations are warranted to determine the exact reasons for this finding. The role of a long duration of hearing deprivation is not well established. Although the effectiveness of early CI can be the same as that after long hearing deprivation, it is rational to increase the duration of life spent by the patient with the privilege of better hearing with CI.

Primary Author/Presenter: Isra Aljazeeri

Author Block: Isra A. Aljazeeri, Fellowship trained consultant otology neurotology1, Abdulrahman Alomar, MD2, Fatimah AlTassan, MD3, Jawaher Alkhayyal, MD3, Abdulrahman Alsanosi, Professor3;1Otology, Ministry of health, Houfuf, Saudi Arabia, 2Otology, King Saud Univ. Med. City, King Saud Univ.; and from the Coll. of Med., Riyadh, Saudi Arabia, 3Otology, King Saud Univ., King Abdullah Ear Specialist Ctr., Riyadh, Saudi Arabia.

Learner Objectives:
The demographics and change in trends of adult CI surgeries in Saudi Arabia.
What are the lessons learned from this study?
**Abstract Content:**

Introduction: Sound is an important source of information for animals living in their environment. It provides animals with information about objects at distances beyond what can be provided by vision and in all directions. Sound provides an animal with a three-dimensional “view” of its world, and this view is not hindered by currents, light levels, or even the presence of most objects in the environment. Mammals exhibit remarkable variety in their sense of hearing; from elephants communicating with infrasonic sounds to bats navigating their environment through echolocation calls at ultrasonic frequencies, many non-human mammals hear outside the typical human hearing range. Interestingly enough, this large variance in sound perception finds its basis in the smallest mammalian bones— the ossicles of the middle ear.

Methods: The origin of sensory structures within the skull began with the epithelial ciliated cell 1.5 billion years ago in prehistoric life forms. About 380 million years ago, as fish further evolved to migrate toward the land, there was a need for a major modification to detect sound transmitted through the air rather than water. Adaptation to land helped in the formation of the middle ear. The beginning of mammal evolution was first seen in the Triassic period about 230 million years ago, during which all land vertebrates developed tympanic middle ear. Due to simultaneous changes in the jaw joint, number of bones at the back of the jaw joint were freed, and established a middle ear containing three ossicles.

Results: Human hearing is thus the end product of long and complex evolutionary steps, its primordium having first evolved from gill slits & jawbone of ancient fishes. The vertebrate auditory system was more refined and had developed special tasks like acoustic feature discrimination, sound source localization, frequency analysis, and auditory scene analysis in coordination with the visual inputs.

Conclusion: In the present era role of artificial intelligence increased, and various methods are developed for communication. Research on computer-based brain-to-brain communication is going on to improve the ways people can communicate in the face of limitations— those who might not be able to speak or have sensory impairments. The telepathic ability has always been with us. Humans evolved with it. We still have it and experience it at times in our lives but are not smart enough to understand or realize it. In future, there are chances of a part of the brain developing in such a way that will be able to communicate brain to brain itself.

**Primary Author/Presenter:** Rohit Mehrotra

**Author Block:** Rohit Mehrotra, MS ENT MEHROTRA ENT HOSPITAL, KANPUR, India.

**Learner Objectives:**

Discuss the future of hearing and telepathy
Abstract Content:

Introduction: While prior studies have demonstrated that cochlear implantation (CI) prevalence remains low (approximately 2-13%) in the qualifying adult patient population in the U.S., data describing the incidence of CI among candidates are limited making it difficult to quantify the degree to which utilization is changing over time. The current study evaluates the association between age and CI incidence among adults aged 20 years and older residing in the U.S.

Methods: Deidentified CI data were acquired from prospectively collected patient registries from two CI manufacturers (Cochlear Americas and Advanced Bionics), which supply an estimated 85% of CIs in the U.S. Rates of severe-to-profound sensorineural hearing loss by age group was extracted from Census and National Health and Nutrition Examination Survey (NHANES) data. Incidence rates are presented per 100,000 person-years.

Results: The study cohort included 30,066 adults ≥20 years old who underwent CI between 2015 and 2019, with a median age of 70 (IQR 58-78). The annual number of CIs increased from 4,598 in 2015 to 7,300 in 2019. Overall, the incidence of CI among adult traditional (bilateral severe-to-profound hearing loss) CI candidates increased from 207 in 2015 to 300 in 2019. In 2019, the 30-39-year-old age group had the highest incidence (995) among candidates, compared to the lowest among those ≥80 years old (173). Among adults with severe-to-profound hearing loss in at least one ear, incidence increased from 68 in 2015 to 99 in 2019. When estimating the total market share including all three CI manufacturers, the overall incidence of CI among traditional candidates was 305, while the overall incidence among those with severe-to-profound hearing loss in at least one ear was 100.

Conclusion: The incidence of CI among traditional candidates and those with unilateral hearing loss increased between 2015 and 2019. The elderly population continues to have the lowest incidence of CI among candidates.

Primary Author/Presenter: Ashley Nassiri

Author Block: Ashley M. Nassiri, MD, MBA1, John Marinelli, MD2, Christine Lohse, MS3, Matthew Carlson, MD2,1Otolaryngology, Univ. of Colorado, Denver, CO, 2Otolaryngology, Mayo Clinic, Rochester, MN, 3Mayo Clinic, Rochester, MN.

Learner Objectives:

Describe the incidence of cochlear implantation and changes over time within the adult cochlear implant candidate population

Understand discrepancies in incidence across age groups
Introduction: Since the advent of cochlear implants (CI), individuals with severe-profound sensorineural hearing loss have been given access to sound through the electrical stimulation of the auditory nerve improving their ease of communication when traditional amplification was no longer of benefit. Historical review of these advancements show continuous improvements in electrode and processor design that meet the needs of a heterogeneous population from infancy to geriatrics. The first cochlear implant systems did not contain a magnet encased within the internal device that would align with the speech processor’s transmitting coil. The 1980’s brought the use of rare-earth magnets to cochlear implants and thus an easy way to connect the outer and inner portion of a CI system. The first commercially available cochlear implants were incompatible with MRI requiring the removal of an internal device’s axial magnet when a recipient required this type of imaging. It was not until 2015 that CI manufacturers began to create and offer internal devices that use diametric magnets which provided CI recipients a safe solution allowing them to undergo MRI without an additional invasive procedure. While this has been advantageous for many, it has created a unique problem for some recipients that, in certain circumstances, required further medical intervention to achieve improvement.

Methods: A retrospective chart review from a large tertiary CI center was completed on 386 pediatric CI recipients who use an MRI-compatible cochlear implant system in at least one ear. Trends in magnet strength needs were examined as well as steps taken to address the most challenging cases in which device retention issues were problematic. This study highlights four specific cases that required additional intervention in order for each recipient to be able to use their CI and have consistent access to sound.

Results: Skin-flap reduction surgery was pursued in all four cases. For one recipient, a second attempt at thinning the skin over the internal device was necessary. Creative means for keeping speech processors affixed to the scalp were trialed until an acceptable solution was found. In one case, the weight of the patient appeared to be a contributing factor.

Conclusion: Following the industry change to routine use of MRI-compatible cochlear implants, audiologists and surgeons have encountered unique problems related to device retention in a subset of patients. Surgical intervention may be necessary but is often considered a last resort. Changes in speech processor configuration (ear-level vs. off-the-ear), hair style and retention accessories prove helpful for these recipients, especially for those when the issue is otherwise unexpected.

Primary Author/Presenter: Jennifer Woodard

Author Block: Jennifer Woodard, AuD, Erika Gagnon, AuD, Melissa Anderson, AuD, Carlton J. Zdanski, MD, Kevin D. Brown, MD; Otolaryngology, Univ. of North Carolina - Chapel Hill, Durham, NC.

Learner Objectives:

- identify magnet strength needs that are outside the range of normal.
- discuss options to address problematic retention cases.
CI2023 Dallas: Cochlear Implants in Children and Adults
Introduction: Cochlear implants (CIs) have proved to be very effective in permitting children with severe to profound hearing loss to acquire oral language with the support of intervention following implantation (Geers et al., 2003). In general, lexical, semantic, pragmatic, and phonological knowledge are not particularly vulnerable in children with CIs. Morphosyntax has been reported as the most challenging linguistic area since early stages of cochlear implantation research (Davies et al., 2020). One particular area of morphosyntax that has recently received attention in children with CIs is the use of clitic pronouns (Giustolisi et al., 2020). Clitic pronouns are present in most Romance languages and, unlike full pronouns in English, they are unstressed morphemes that must be attached to a verb. In general, perception and application of prosodic cues are more challenging for children with CIs since the transmission of spectro-temporal information is limited by their implant. The present study investigates how children with CIs who speak Brazilian Portuguese process sentences with clitics and how they benefit from sentence stress. We hypothesize that children with CIs who speak Brazilian Portuguese will show decreased accuracy in comprehending sentences with clitic pronouns when compared to matched NH peers. Additionally, we hypothesize that children with CIs will not benefit from suprasegmental cues of sentence stress in the same way as children with NH.

Methods: Fifteen children with NH and 13 children with CIs and participated. All children (8;0-12;7 years) were monolingual speakers of Brazilian Portuguese and had normal vocabulary scores and nonverbal IQ. All children with CIs were prelingually deafened and were implanted before the age of four. The experiment consisted of a computerized sentence comprehension task. Sixteen sentences that contained a reflexive clitic like in (a) composed the target experimental sentences of study. a) A avó<sub>N1</sub> atrás da mãe<sub>N2</sub> está se olhando. The grandma<sub>N1</sub> behind the mom<sub>N2</sub> is looking at herself. Each sentence was recorded in two different prosodic forms varying stress placement on noun 1 (N1)dad or noun 2 (N2) grandpa, the two possible antecedent nouns to the clitic pronoun. Unstressed words were produced with shorter duration and lower frequency than stressed words.

Results: A mixed effects generalized logistic linear regression model was applied to the binary data with random effects that account for the within-subject correlation (BIC=887.556). Children with NH were significantly more accurate than children with CI in comprehending sentences with clitics in both stress conditions. For children with NH, stress on the correct antecedent (N1) significantly increased sentence comprehension accuracy. For children with CI, there was no significant effect of stress on selecting the correct antecedent. No statistically significant correlations were observed between acoustic measures and comprehension of sentences with clitics, regardless of stress condition.

Conclusion: Children with CIs have difficulties processing sentences with clitics. We discuss that the challenge seem to arise from a syntactic deficit and sentence stress does not benefit comprehension of such sentences for these children. These findings points to the need of more careful and language-specific analysis of syntactic, morphosyntactic, and prosodic skills in children with CIs in order to plan an effective treatment.
Learner Objectives:

Compare the comprehension of sentences with clitic pronouns by children with cochlear implants and children with normal hearing

Explain the role of prosodic information in supporting comprehension of sentences with clitics
Empowering Prelingually Deafened Cochlear Implant Recipients to Become Successful Audiologists

Introduction: There is a growing number of audiology students who use CIs. One of the authors received bilateral CIs sequentially when she was young, and she is currently studying in the audiology graduate school. Like the author, these students can provide exceptional patient care as they can relate to patients with empathy, build good rapport, and counsel patients and families with knowledge and experience. However, these students confront inevitable challenges in graduate classrooms and clinics. The purpose of this study was to identify the challenges in classrooms, audiology clinics, and social life for audiology students who use CIs and to address solutions and strategies to overcome these challenges.

Methods: First, challenges for graduate students with CIs were identified and listed in academic and clinic settings based on the authors' experiences, clinic educators' feedback, and peer colleagues' input. Strategies for each challenge were addressed through brainstorming and practice from authors, faculty, colleagues in the department, CI manufacturer audiologists, and engineers for audiologic equipment. These possible solutions were formulated shared with other audiology graduate students with CIs and clinic instructors outside the department clinic. A questionnaire was also created to obtain the patient and the family's satisfaction working with the graduate student with CIs. Second, socioemotional aspects are further explored in addition to the academic and clinic areas. For this, we will create a questionnaire for students and adults who grew up with hearing loss. This questionnaire includes items to explore the effect of hearing loss especially on the socioemotional aspects, including their mental health, quality of life, self-image, relationships, and their coping methods. The questionnaire will be distributed online and shared through various organizations, including Association for Audiologists with Hearing Loss, Hearing Loss Association of America Young Adults Group, etc.

Results: Two critical challenges for classroom learning were the poor quality of auditory input and lack of visual input. The use of the remote microphone and captioning at real time were most helpful to reduce the difficulties. Three critical challenges for audiology clinics were listening check of hearing aids, listening check of sound processors, and audiomteric testing. The remote microphone technologies again were to be the most effective tool to carry out various clinical procedures successfully. Listening checks of hearing aids were done using Verifit 1 or Verifit 2 with a remote microphone. Listening checks of any sound processor were accomplished with a remote microphone and listening check devices provided for each CI manufacturer. To avoid communication breakdowns during audiometric testing and being unable to understand patients for speech perception testing, patients were informed that the clinician is a bilateral CI user, and the patient was instructed to wear the remote microphone. Self-advocacy skills were essential to be successful in classrooms as well as clinics as well.

Conclusion: While audiology programs have welcomed students with CIs, there are obstacles that students with CIs and educators come across in the training. This study demonstrated some challenges and solutions to prepare CI recipients to be successful clinicians. Social-emotional aspects and more strategies will be discussed at the conference.
Learner Objectives:

Describe how CI recipients can do the hearing aid and/or sound processor listening checks using remote microphones

Discuss various advocacy skills that graduate students with CIs utilizes in classrooms and clinics to become successful audiologists
**CI2023 Dallas: Cochlear Implants in Children and Adults**

**Poster Exhibit Abstract**

**Poster Category:** (Re)habilitation, Comprehensive Health Services, and Educational Aspects

**Poster Exhibit Number:** 85 **Student Poster Competition?**

**Abstract Number:** 18

**Poster/Abstract Title:** Assessing post cochlear implantation Anxiety and corella ting it to socio demographic and clinical characteristics

**Abstract Content:**

Introduction: There is a greater incidence of mental health problems among children with hearing impairment compared to controls. A high proportion of children with hearing impairment experience delays in understanding, recognizing, and using emotional expression. There are additional difficulties in post-cochlear transplant patients that may increase the risk of developing psychopathology, such as anxiety disorder.

Methods: Study design: This study is a retrospective study. Study setting and timetable: ➢ Forty children with cochlear implants had been included in the study. Six children had been operated on at Misr University Teaching Hospital, 14 children had been operated on at International Golf Hospital, and 20 children were operated on at Air Force Military Hospital during the period from 2014 to 2017, Cairo, Egypt.➢ The study was done 4 years after the last cochlear implant operation.➢ The questionnaire included in the study was obtained from each child’s mother.

Results: Forty mothers of children who underwent cochlear implantation surgery responded to the Spence Preschool Anxiety Scale. Socio-demographic, medical, and perioperative data of children were obtained from medical records. On the Spence Preschool Anxiety Scale, 21 out of 40 children (52.25%) have a positive total score. On obsessive-compulsive disorder, physical injury fears, generalized anxiety, separation anxiety, and social anxiety subscales, the numbers of children who scored positive are 23 (57.5%), 18 (45%), 18 (45%), 10 (25%), and 6 (15%), respectively.

Conclusion: Anxiety disorders are common in post-cochlear transplant children.

**Primary Author/Presenter:** Ihab Nada

**Author Block:** Ihab M. Nada, MdENT, Misr university for science and technology, Cairo, Egypt.

**Learner Objectives:**

- Cochlear implantation and anexeity
- Socio demographic and cochlear implantation
Adult Aural Rehabilitation

Introduction: Aural rehabilitation is not standardized for adults after cochlear implantation. Most cochlear implant (CI) centers in the United States do not routinely enroll adult CI users in focused postoperative rehabilitation programs due to poor reimbursement and lack of clear data about aural rehabilitation outcomes. Adult CI patients generally assume a self-directed approach toward rehabilitation. Our pilot study examined the outcomes of a formal rehabilitation program pursued by adults with CIs.

Methods: Cross-sectional study of 15 adults with post-lingual deafness post CI with 3-6 months of formal speech rehabilitation and guided self-rehabilitation. All the patients underwent a formal speech evaluation during the CI evaluation process in best aided conditions. All patients were activated 2-3 weeks after their CI surgery and started formal speech therapy 2 weeks after activation. Preoperative speech evaluations consisted of PPVT4 and minimal pairs, preoperative audiologic evaluations consisted of CNC and AZBio. All the testing was repeated at the 3 month interval.

Results: 15 adult patients were followed. There were 7 males and 8 females. Age range 22-88 years. 12 patients had bilateral severe to profound sensorineural hearing loss (SNHL), 2 patients had single-sided deafness and 1 patient had moderate to severe SNHL with <20% speech recognition scored. All patients had in-person weekly speech therapy for 1-6 months postoperatively. All the patients had post-operative speech therapy preapproved and covered by their health care plans. In addition, 11 patients performed guided self-rehabilitation industry apps specific to CI recipients or audiobooks. It was noted that their preoperative speech assessment with lip reading was quite good (62%-100%) as opposed to binaural AZBio in quiet (0%-56%). 2 patients struggled with wear time postoperatively. The patients who did self-guided and formal speech therapy had improvement in their speech and AZBio measures within 3 months of implantation.

Conclusion: Formal adult speech rehabilitation with guided speech therapy can be covered by health care plans and appears to be beneficial to patients. Larger-scale extensions of this pilot study are needed.
Abstract Content:

Introduction: Early detection, amplification, and intervention is critical for children who are deaf or hard of hearing seeking listening and spoken language outcomes. Promoting intense intervention from all members of a child’s professional team is necessary to close the language gap between children who are deaf and hard of hearing with their typical developing, same-aged peers. Programs in the nation specialize in listening and spoken language by emphasizing early detection, a team approach, providing a structured learning environment, and using specific techniques for optimal listening and spoken language outcomes. According to Wiggin, et al. (2021), the goal of early childhood intervention programs is for children who are deaf or hard of hearing to have typical language development similar to their typical hearing peers and that study revealed vocabulary scores increased over time with increased intervention services. The current study reviews standardized language scores of 30 children, 3 years to 6 years of age with bilateral cochlear implants, enrolled in a structured listening and spoken language program for three consecutive years. The purpose of this study is to analyze language scores for these children throughout their early childhood enrollment while simultaneously receiving appropriate audiological management and speech and language therapy services.

Methods: Total, receptive, and expressive language scores for 30 bilaterally implanted children were analyzed during their preschool, pre-kindergarten, and kindergarten years while enrolled in a full-time structured listening and spoken language program. The standardized language assessments that compared performance to typical developing children included the Preschool Language Scales - 5th Edition, Clinical Evaluation of Language Fundamentals Preschool - 3rd Edition, Comprehensive Assessment of Spoken Language - 2nd Edition, Clinical Evaluation of Language Fundamentals Preschool - 2 Spanish, or the Preschool Language Scales - Fifth Edition Spanish. Results: Overall results indicated that the children who performed within average range for core language skills increased over time from 10% to 33% after enrollment in a listening and spoken language program from preschool to kindergarten. Within average range receptive language scores also slightly increased over the three-year period indicating an increased understanding of language for children exposed to many listening opportunities and auditory bombardment of age-appropriate language structures. The expressive language skills of the 30 children studied also increased from 10% to 33% scoring within average range. The children who scored within the severe language delay range stayed around the same within three years of a structured listening and spoken language environment.

Conclusion: Preliminary results of this study revealed that 33% of the children who are bilaterally implanted and enrolled in a full-time early childhood listening and spoken language program for at least three years performed within average range for overall language skills. Further research should be conducted to determine differences in audiological management prior to preschool enrollment. Other confounding variables that could affect language progress over time such as additional developmental delays, another language primarily spoken in the home, and wear time of audiological equipment and should also be further reviewed.

Primary Author/Presenter: Monica Dorman
Cochlear Implants in Children and Adults

Author Block: Monica Dorman, Master of Science, Jessie E. Ritter, Master of Arts, Stacy Adams, Master of Science; Speech Language Pathology, Sunshine Cottage Sch. for Deaf Children, San Antonio, TX.

Learner Objectives:

describe examples of aggressive intervention services provided to children who are deaf or hard of hearing enrolled in a listening and spoken language program.

describe the receptive and expressive language skills of children who are deaf or hard of hearing enrolled in a listening and spoken language program.
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: (Re)habilitation, Comprehensive Health Services, and Educational Aspects
Poster Exhibit Number: 88 Student Poster Competition?

Abstract Number: 36
Poster/Abstract Title: Digital Inclusion for Cochlear Implant Recipients

Abstract Content:

Introduction: Individuals with significant hearing loss struggle to communicate with family, friends, and co-workers due to the magnitude of the barrier that hearing loss creates. Alternative ways to communicate, (via texting and email), to learn (via websites and instructional videos), to engage in therapy and clinical support (via video conferencing and customised Apps), and to participate in social activities (via social media outlets) mediated through the internet are important avenues for those with hearing loss to overcome communication challenges. Many cochlear implant recipients may have internet access but lack skills to harness and maximize the full potential of their personal technologies. A barrier for some is the lack of foundational knowledge and confidence to use recent advancements in tele-practice, remote accessibility, and user Apps and websites via the internet. The purpose of this study is to identify CI recipients’ current skills and barriers to digital inclusion via questionnaires and assessments and provide training in the specific areas of need. Categories of assessment and training include 1) internet safety, 2) basic internet functions, 3) use of CI technology and other assistive devices that rely on the internet, and 4) rehabilitation materials for independent practice.

Methods: Adult CI recipients completed a baseline quality of life survey and questionnaires related to their knowledge and use of the internet and their own hearing technologies. The Internet Skills Scale (Alexander, et al., 2016) was modified for this purpose. They participated in individual or group training on the four categories of training and, after 3 months, were reassessed on baseline measures. Training materials were compiled in an e-portfolio and shared via paper files in notebooks or electronic files, depending on the individual.

Results: This study is ongoing; to date, CI recipients enrolled ranged in age from 57 to 88 years, with cochlear implant use length ranging from 3 months to 16 years. Baseline assessment identified the most common need for training related to independent use of hearing technology functions and Apps. Increases in frequency of internet use for various purposes increased for most participants after training. Changes in quality-of-life ratings changed positively for some participants after the 3-month evaluation. Self-evaluation of skills improved over-time across a continuum of needs identified by each participant.

Conclusion: This work is based on assumptions that increased awareness and knowledge will lead to more opportunities for safe internet use by CI recipients; that directed and specific training will improve confidence and increase CI recipient independence with internet use; that increases in digital inclusion for CI recipients will improve their satisfaction with hearing technologies and enhance their quality of life. Benefits to the clinic could manifest from greater client use of tele-practice and remote care.

Primary Author/Presenter: Holly Teagle

Author Block: Holly F. Teagle, AuD1, Jessica Ong, MA Audiology2;1Audiology, The Univ. of Auckland, Auckland, New Zealand, 2Audiology, The Hearing House, Auckland, New Zealand.

Learner Objectives:

Attendees will identify key areas of internet competency CI recipients need training in to support digital inclusion.
CI2023 Dallas: Cochlear Implants in Children and Adults

Attendees will describe how digital inclusion skills impact CI recipients’ quality of life
**Abstract Content:**

Introduction: The paediatric Auditory Implant team at RNENT created a series of ‘flower’ workshops for prelingually implanted children and their families who are awaiting surgery and in the first two years post implantation. The workshops were created in response to the stress and uncertainty parents often report before surgery and help shape realistic expectations. Workshops focus on surgery, activation, listening and language development and parent-child interaction. They provide practical strategies to facilitate listening and language development. Further sessions are also offered within the first two years of implantation as clinically indicated. Evidence suggests that prelingually implanted children achieve greater outcomes if they access high quality parent language input. Targeted rehabilitation is subsequently offered to families of children who are not making expected progress.

Methods: An audit was undertaken of all families who have attended the workshops between 2019 and 2022. We reviewed our cohort to better understand their needs of our families to shape future service provision.

Results: Attendance has been 100% for the workshops. Interpreters were required for approximately 25% of our workshops. Barriers to accessing further workshops for our children included insufficient processor use, additional diagnosis impacting progress or complex social issues. In addition, those with accelerated progress were not offered further groups. Targeted individual sessions were offered to approximately 30% our children and families.

Conclusion: The workshops have supported families awaiting surgery and through the early years post implantation. The team have embedded key rehabilitation information from the start of the child’s implantation journey. The team is currently collating objective measurements to examine the impact of the workshops, including parent and patient outcomes.

**Primary Author/Presenter:** Lisa Nash

**Author Block:** Lisa Nash, PG Dip Speech and Language Therapy, Liz Cullen, Speech and Language Therapy, Ann East, Deaf Education, Emily Brooks, Deaf Education; Auditory Implant Department, Univ. Coll. London Hosp., London, United Kingdom.

**Learner Objectives:**

Identify a new way of working with prelingually implanted children and families in order to promote parental engagement from the start as this is a key indicator of a child’s listening and language progress.
Abstract Content:

Introduction: Children with cochlear implants (CIs) exhibit great variability in their vocabulary outcomes (Majorano et al., 2018), despite a younger age at implantation favors better language development (Boons et al., 2013). Among the variables possibly affecting early vocabulary skills are individual differences in music exposure and engagement and in parental musicality, as studies show that these factors influence language outcomes in children with typical and atypical development (Ladányi et al., 2020; Nayak et al., 2021; Torppa & Huotilainen, 2019). To explore this hypothesis, we conducted a longitudinal study on 16 Italian children with CIs with severe to profound deafness.

Methods: To explore this hypothesis, we conducted a longitudinal study on 16 Italian children with CIs with severe to profound deafness. We tested the sample before implantation (mean age=16 months, SD=7.7, range=9-32) and at three, six, and twelve months after CI activation. Children’s vocabulary was measured using the MacArthur-Bates Communication Development Inventory (MB-CDI) and video-recordings of mother-child interactions at each session. Children's music exposure over the first year after CI activation was acquired by data logs from children’s devices. Self-report questionnaires measuring musicality and engagement with music were administered to mothers (Müllensiefen et al., 2014; Politimou et al., 2019).

Results: Preliminary analyses with maternal education as covariate showed that mothers’ musicality predicted children’s production scores in the MB-CDI three months after activation. Linear regressions showed that average daily exposure to music in the three months after activation significantly predicted children’s comprehension scores in the MB-CDI three months after activation. In both cases, when added in the model, mothers’ self-reported musical variables significantly increased the proportion of variance explained. These findings suggest that mothers’ musical abilities and children's music exposure and engagement in the first months after implantation play an important role in affecting children with CIs’ expressive and receptive vocabulary.

Conclusion: Therefore, for infants and toddlers with CIs, being musically engaged and exposed may mean having enhanced language outcomes, with implications on socio-educational and clinical levels.

Primary Author/Presenter: Letizia Guerzoni

Author Block: Letizia Guerzoni, Phisical Doctor1, Marinella Majorano, Phisical Doctor2, Valentina Persici, Phisical Doctor3, Michela Santangelo, Phisical Doctor4, Domenico Cuda, Medical Doctor1;otolaryngology, Guglielmo da Saliceto Hosp., piacentino, Italy, 2Department of Human Science, Univ. of Verona, verona, Italy, 3Department of Human Sciences, Univ. of Verona, Verona, Italy, 4Department of Human Science, Univ. of Verona, piacentino, Italy.

Learner Objectives:

Exploring the role of music exposure and maternal musicality in supporting vocabulary development in children with CIs.
**Poster Exhibit Abstract**

**Poster Category:** (Re)habilitation, Comprehensive Health Services, and Educational Aspects

**Poster Exhibit Number:** 91  
**Student Poster Competition?**

**Abstract Number:** 72

**Poster/Abstract Title:** Language profile of Egyptian children using unilateral cochlear implants

**Abstract Content:**

Introduction: to assess the morphosyntactic aspect of language in Egyptian children after 5 years of using unilateral cochlear implants and studying the factors that affect their progress: the chronological age, the age of implantation, the gender, and the duration of using a cochlear implant. Also, to assess which of the subcategories of the morphosyntax are affected to help in designing a suitable rehabilitation program.

Methods: 36 Egyptian children using unilateral cochlear implants regularly were enrolled in this cross-sectional study. During the assessment, the chronological age of all children was ranged from 6 years, 7 months to 11 years, 9 months, the duration of using cochlear implants of all children was at least 5 years. The morphosyntactic aspect of language as a part of the REAL scale (Receptive Expressive Arabic Language Scale) was applied by expert Phoniatricians.

Results: Morphosyntactic score was affected negatively by the chronological age, on the other hand, it was not affected by the age of implantation, the gender, or the duration of using cochlear implant.

Conclusion: After 5 years of regular rehabilitation of Egyptian children using unilateral cochlear implants, the morphosyntactic profile can be described as still low compared to normal children. These children have developed many items in morphosyntactic aspects like possessiveness, derivative adjectives, and passive tense but still have a defect especially in male plural formation, past tense, adjectives, and irregular plural formation.

**Primary Author/Presenter:** Ahmed Abdelmonem

**Author Block:** Ahmed A. Abdelmonem, MD, Tarek ElDessouky, MD; ENT, Beni_suef Univ., Benisuef, Egypt.

**Learner Objectives:**

- language development of Egyptian children using unilateral CI
- language deficits of Egyptian children using unilateral CI
Abstract Content:

Introduction: Most patients with sporadic and neurofibromatosis type 2 (NF2)-related disease ultimately acquire non-serviceable hearing in affected ear(s), either as a result of the natural history of disease or a consequence of treatment. Recent evidence suggests that patients undergoing cochlear implantation (CI) after stereotactic radiosurgery (SRS) for vestibular schwannomas is associated with favorable audiometric outcomes. Both procedures are typically performed at a tertiary referral center, which provide care for patients from a large geographic catchment. It can be difficult for many patients to coordinate multiple trips to a large referral center when they live in a geographically distant or remote area. In this series, we present our experience with coordinated CI performed within a month of SRS treatment for VS.

Methods: The authors conducted a retrospective chart review of adult patients with VS who underwent SRS followed by CI within one month at a single tertiary care referral center between 2015 to 2022. Patient demographics, tumor pathology, treatment parameters, and pre- and post-implantation audiometric and clinical outcomes are presented.

Results: Ten patients underwent SRS followed by CI within one month during the study period. Four (40%) patients had Neurofibromatosis Type 2 (NF2). The median age at treatment was 65.5 years (range 36 – 84 years) and 8 patients were male (80%). The median marginal dose was 13 Gy with a median treatment volume of 1100 mm3. The median time from SRS to CI was 1.0 days (range 0 – 31 days). The mean pre-implantation AzBio sentence score was 8.9 % (range 0 – 36%). Overall, 8 patients (80%) demonstrated open-set speech understanding. Sentence testing was performed at a median of 12 months (range 6 – 24 months). The mean post-implantation AzBio sentence score was 68.4% (range 44 – 94%). One patient had environmental sound awareness and one patient did not use the implant due to pain.

Conclusion: CI after SRS for VS generally provides excellent audiometric outcomes. Placement of the CI in the immediate post-treatment period after SRS is convenient for the patient and does not appear to negatively impact clinical outcomes. Early CI after SRS can be considered in select patients who would benefit from the implant to expedite their hearing rehabilitation.

Primary Author/Presenter: James Dornhoffer

Author Block: James R. Dornhoffer, MD, Aaron Plitt, MD, Michael J. Link, MD, Brian A. Neff, MD, Colin L. W. Driscoll, MD, Matthew L. Carlson, MD; Otolaryngology, Mayo Clinic, Rochester, MN.

Learner Objectives:

At the end of the session, participants will recognize that same-day or next day cochlear implantation after radiosurgery for vestibular schwannoma offers an excellent audiometric outcome and may represent a way to expedite or improve access to hearing re
Introduction: Patient-provider communication is a crucial aspect in patient-centered care and service provision. It is associated with adherence to therapy, patient outcomes and satisfaction (e.g. Beach et al. 2006). In contrast, communication barriers, such as lack of warmth, failure to consider the patient concerns and experience, lack of clear explanations, and excessive use of medical jargon, are all associated with lower levels of satisfaction (Roter et al. 1997). Limited research has examined the impact of provider communication and service provision on cochlear implant patients. Therefore, we are set out: (1) to assess the quality of communication between audiologists and cochlear implant patients, and (2) to assess the relationship between provider communication and the patient’s satisfaction and perceptions regarding service provision.

Methods: Cochlear implant recipients presenting to our center will be recruited for this study. Patients have to be 18 years or older, post-lingually deafened adults, with at least 9 months of post-implantation experience - to increase the likelihood of stable fitting parameters (Ou et al. 2008). Several patient characteristics will be recorded including age, gender, age at implantation, duration of cochlear implant use, race and ethnicity, socio-economic status, educational attainment, employment, and health insurance, etc. Patients will complete a set of questionnaires immediately following their visit with the audiology provider. Specifically, patient-provider communication will be assessed using the Patient Perception of Patient Centeredness questionnaire (Ryan et al. 2019). This instrument covers four components of patient-provider communication: (1) exploring health, disease and illness experience; (2) understanding the whole person; (3) finding common grounds; and (4) enhancing relationship. Patients will also complete the Healthcare Climate Questionnaire, which measures provider’s support for patient autonomy in decision making. Patient satisfaction will be assessed using the Medical Outcomes Study (MOS) survey, which is used to evaluate periodic and visit-specific satisfaction regarding service provision.

Results: This study is still in progress. Pilot data from at least 10 - 20 cochlear implant patients will be described in this presentation.

Conclusion: Patient-provider communication is a powerful predictor of patient satisfaction (Jackson et al. 2001). Therefore, we anticipate that the communication of the audiologist will affect the satisfaction of cochlear implant patients with the provision of care. We anticipate that better provider communication will be associated with improved levels of patient satisfaction. In contrast, poor provider communication behaviors could compromise care satisfaction and perception of service provision. The findings of this study will provide an opportunity for reflection, and may identify specific communication behaviors that need to be changed to improve satisfaction in cochlear implant patients.

Primary Author/Presenter: Dania Rishiq

Author Block: Frances Ange, BA, Katherine Snively, BA, Wilder Roberts, Au.D., Amy Nichols, Au.D. Ph.D., Dania Rishiq, Ph.D.; Univ. of South Alabama, Mobile, AL.

Learner Objectives:
At the end of the session, participants will be able to recognize the importance of patient-provider communication in patient-centered care.
**Abstract Content:**

Introduction: The use of auditory verbal strategies and early intervention supports pre- and post-cochlear implantation are essential for language acquisition of deaf and hard of hearing children who use listening and spoken language as their primary mode of communication. Although there is evidence supporting the use of strategies between caregivers and their deaf and hard of hearing children for language development in listening and spoken language, there is limited research on the use of these strategies with linguistically diverse deaf and hard of hearing children. There is an increasing number of linguistically diverse families in the United States. Although specific listening and spoken language strategies have been developed to increase spoken language development in all deaf and hard of hearing children, it has not been determined if these strategies are equitably used among families from linguistically diverse backgrounds.

Methods: The current study investigated the frequency of listening and spoken language strategies used by caregivers (N = 12) of linguistically diverse households as well as explore if there was an association between home linguistic environment and the degree of the child’s hearing loss in addition to a group difference between number of listening and spoken language strategies used by caregivers from monolingual and bilingual households. Specifically, the use of these strategies was examined through coding a 15-minute recorded video interaction, via the ELAN coding program, between each caregiver and deaf and hard of hearing child in early intervention pre-cochlear implantation. The group difference between the use of these strategies in monolingual and bilingual households as well as the association between home linguistic environment for a caregiver/child dyad and the degree of hearing loss for the child were assessed via SPSS.

Results: Results indicated that caregivers demonstrated greater selections of repetition, expectant look, and self-talk/parallel talk, which was most statistically significant. Although there was not a statistically significant difference between monolingual and bilingual groups, both strategies of auditory sandwich and expectant look approached significance at p values of .053 and .060, respectively, indicating a marginally significant difference between the two groups. Caregivers from monolingual households demonstrated greater selections of auditory closure, auditory sandwich, repetition, wait time, and whisper. On the contrary, caregivers from bilingual households demonstrated greater selections of expectant look and self-talk/parallel talk. Lastly, there was a marginally significant association between home linguistic environment for a caregiver/child dyad and the degree of hearing loss for the child.

Conclusion: The findings of this study have implications for practice and literature. This study extends the literature by investigating the types of strategies used naturally in linguistically diverse households and directly relates to the future suggestions of Bunta et al. (2016), which encourages home language use as well as providing treatment support in the home language to help with language development in spoken English and the home language. Overall, the results of this study inform early intervention providers what dual-language supports are needed, regarding strategies used by caregivers, to ultimately improve children’s language outcomes.

**Primary Author/Presenter:** Brynne Powell

**Author Block:** Brynne Powell, M.E.D., MPH, Elaine Smolen, Ph.D., Maria Hartman, Ph.D., Ronda Rufsvold, Ph.D.; Teachers Coll., Columbia Univ., New York, NY.
**CI2023 Dallas: Cochlear Implants in Children and Adults**

**Learner Objectives:**

compare the use listening and spoken language strategies used in early intervention among diverse caregivers and their deaf and hard of hearing children.

modify individualized listening and spoken language early intervention support pre- and post-cochlear implantation to increase overall language outcomes in the deaf and hard of hearing population.
Abstract Content:

Introduction: Children born with sensorineural hearing loss (SNHL) are at increased risk for delays in motor, sensory, and social skills development. However, few studies have examined targeted interventions to make timely referrals and identification of associated developmental delays in this population. In an initial study, a multidisciplinary team at a tertiary medical center implemented an enhanced screening process to identify potential developmental delays of children (<5 years of age) who were cochlear implant (CI) candidates or who had already received CIs. Thirty-one children were screened; 20 children (65.5%) were identified as at-risk for delay in at least one area of development and were referred for further evaluation (i.e., physical therapy (PT), occupational therapy (OT), or Developmental and Behavioral Pediatrics). The purpose of this follow-up study was to conduct a needs assessment to further understand the impact of this new screening process on the children who were identified as at-risk and enhance CI clinic services for children with SNHL and their families.

Methods: This quality improvement (QI) project involved collection of qualitative and quantitative data from several participant groups. Phone interviews were conducted with parents/caregivers of children who screened positive as at-risk for delay in the initial study. Surveys were collected from 1) therapists who received referrals for children who screened positive for developmental delay and 2) therapists with experience treating children with SNHL to better understand best practices for assessment and treatment of this population. Results were analyzed using descriptive statistics and thematic analysis.

Results: Preliminary results reveal a majority (70.6%) of parents interviewed (n=15) thought it would be beneficial to have more information about the services their child was being referred to after this screening process (OT, PT or Developmental and Behavioral Pediatrics). Parents stated that informational packets and face-to-face delivery would be the preferred methods for this education (40.0% and 53.3% respectively). Overall, parents understood the benefits that OT, PT, and SLP could provide for their child; 25% of caregivers reported they did not understand the purpose of a referral to Developmental and Behavioral Pediatrics. A majority of the community therapists (n=35) did not feel their education and training prepared them for treating children with SNHL and CIs (62.9%). Therapists reported the most popular interventions for this population included sensory integration (59.4%), a focus on attainment of developmental milestones (56.3%), and Socioemotional Learning programs (37.5%).

Conclusion: The results of this study indicate that parents who participated in this new screening process felt that additional information is needed to build a greater understanding about potential developmental delays and possible impact of therapy services for their child. Community therapists would benefit from additional training about the unique needs of children with SNHL and CIs to better evaluate and implement high-quality interventions for this population. The results of this study inform an ongoing collaboration between the Cochlear Implant Clinic, the Division of Occupational Therapy, and the Department of Developmental and Behavioral Pediatrics to assure equitable and timely access to services for children with SNHL receiving CIs.

Primary Author/Presenter: Sophie Sherman
Learner Objectives:

Discuss the current needs of children diagnosed with sensorineural hearing loss who receive cochlear implants and the unique role of occupational therapy with this population.

Identify potential areas of improvement within the referral process and parental education regarding services.
Poster/Abstract Title: The Invisible Disability of Single Sided Deafness: Improving Hearing Quality of Life Through Group Aural Rehabilitation

Abstract Content:

Introduction: It is important that adults with cochlear implants with Single Sided Deafness (SSD) receive aural rehabilitation in order to establish a home practice routine and use of direct connection to strengthen their auditory skills using the cochlear implant. Additionally, aural rehabilitation provides an opportunity for patients to share their experiences with hearing loss. Patients with SSD often appear to communicate effectively and can engage in typical conversations with family friends and colleagues. However, many of these patients express a sense of loss related to their hearing loss and feel that others do not recognize that they have a disability. A group session for patients to share their experiences, their feelings about hearing loss, and to develop strategies may increase satisfaction and improve feelings about using a cochlear implant.

Methods: Patients over the age of 18 who present with SSD because of sudden or progressive hearing loss, who received a cochlear implant at our clinic were invited to join a rehabilitation group. The aural rehabilitation course is 5 consecutive weeks for 1 hour via Zoom. The sessions are facilitated by a speech language pathologist and an audiologist. Prior to starting the group, each participant will complete a Hearing Handicap Inventory for Adults/Elderly (HHIA/E) and a Vanderbilt Fatigue S-Adult Version-40 items (VFS-A-40). Each session follows a similar routine. Sessions start with an energy check to establish comfort and to identify each patient’s current state as well as related stressors, supports and weekly routines. A prompt related to hearing loss management, technology use, or feelings about hearing loss is presented and each patient is encouraged to respond. Breakout rooms are used to practice using Direct Auditory Input and to establish deeper connections amongst participants. Sessions end with an open forum to ask or comment on a related question. The group is grant funded so there is no cost for participants. Upon completing the course, the HHIA/E and the VFS-A-40 was re-administered. In addition, a clinician created survey was provided to assess course satisfaction.

Results: It is predicted that satisfaction will increase after participating in the group. Data on pre and post HHIA/E and VFS-4-A will be compared. The results will be analyzed to describe the effect of group aural rehabilitation on patients with SSD. It is expected that these patients will show an increase in hearing related quality of life. The clinician created survey will support these findings, as well as provide perspective on each patient’s new knowledge acquired as a result of the course. Expected findings include a better understanding of technology, hearing management and a sense of connectedness with other SSD participants.

Conclusion: Many patients with SSD at our clinic express similar stories related to their hearing loss and cochlear implant. Participation in the aural rehabilitation group diminishes these patients’ feelings of having an “invisible disability” that is unique to them. Additionally, each participants’ feelings about hearing loss are validated within the group setting by hearing similar stories. We expect the data from the subjective scales to support better hearing quality of life.
Learner Objectives:

Explain the outcome of group aural rehabilitation for patients with Single Sided Deafness

Explore the benefits of group rehabilitation for those with cochlear implants for single sided deafness
Abstract Content:

Introduction: Sensory processing and integration are how the brain organizes and interprets sensory experiences of touch, sound, sight, movement, and body awareness. When this process is disordered, the child may exhibit problems in learning, development, or behavior. In children with cochlear implants, sensory integration and processing dysfunction can inhibit the development of speech and language skills, and learning. In our clinic we have observed the common relationship with sensory disorders in children with cochlear implants. The objective of this study is to familiarize the audiologist with sensory processing and integration dysfunction. We will cover the types of dysfunctions associated signs and symptoms, and its impact on children with cochlear implants. We will include a discussion of referrals for evaluation by an occupational therapist.

Methods: Our basic five senses consist of hearing, vision, touch, taste, and smell. In addition, we have the “power sensations”, the vestibular, proprioceptive, and tactile systems. Dysfunction in any sensory system may result in a problem in registration, modulation, and/or integration of sensory processing. At one end of the continuum lies hyporesponsivity (under reaction to a stimulus) and hyperresponsivity (overreaction to a stimulus) at the other. The optimal level of arousal lies in the center of the continuum. Children with cochlear implants already have dysfunction in hearing and often their vestibular system. This may contribute to the imbalance of sensory processing and lack of integration. The role of the occupational therapist (OT) is in the evaluation and treatment of dysfunction in sensory integration. The goal of therapy is to achieve the optimal level of functional independence.

Results: The incidence of sensory processing and integration dysfunction in our clinic is high. Approximately 36% are currently receiving occupational therapy services. Two of the aural habilitation programs in our area report incidence of close to 50% of their clients that exhibit sensory processing integration issues. Occupational therapy services are an important part of our multidisciplinary team.

Conclusion: It is important for the audiologist working with children using cochlear implant to be familiar with signs and symptoms of sensory integration dysfunction. These children may have difficulty developing speech and language unrelated to the function and quality of their cochlear implant. We must consider the whole child, not just the hearing loss and cochlear implant. We are considering adding an OT evaluation to our CI pre-evaluation process.

Primary Author/Presenter: Jolie Fainberg

Author Block: Jolie C. Fainberg, AuD1, Dana Dinet, MS, OTR/L2;1Atlanta Institute for ENT/Atlanta Children's ENT, Alpharetta, GA, 2Sensory Factory, Atlanta, GA.

Learner Objectives:

At the end of the session, participants will be able to define sensory processing and integration

At the end of the session, participants will be able to compare and contrast hyporesponsivity and hyperresponsivity
Hear and Sing: A research plan for the development and pilot study of a mobile game design using voice pitch to control game characters to improve pitch perception and music appreciation.

Introduction: The Hear and Sing is a proposed mobile game that provides a unique user interface that detects the pitch of the user’s voice. Singing high pitched notes moves a game character higher up on the screen. Singing low pitched notes moves the character down. The up/down movement provides visual feedback allowing the student to associate singing high to upward movement and singing low to downward movement.

Methods: Cochlear Implant patients require considerable effort to listen, leading to frustration, fatigue, and negative consequences in school and work performance. Music appreciation and the ability to sing in terms of rhythm and pitch patterns, can improve speech and language development, school readiness, emotional prosody, social inclusion, and career choice. Investigation shows that no software applications exist that interactively teach singing to children with hearing loss by integrating hearing and providing real-time feedback on their singing pitch accuracy. The study design explores staff, parents’, and children’s perceptions of the usability and feasibility of the Hear and Sing app, and the influence of these variables on improved singing accuracy. Specifically, the study is limited to children attending REDACTED SCHOOL FOR KIDS WITH HEARING LOSS, without other co-morbidities, and have bilateral CIs. An exploratory correlational, comparative, and time-series research design, proposes use of the prototype Hear and Sing app with children ages 5-11 who have bilateral cochlear implants that are enrolled in REDACTED SCHOOL FOR KIDS WITH HEARING LOSS. The usability (functionality, accuracy of pitch detection algorithm, usage), feasibility, and singing accuracy are examined with mix-method data from: (1) logging and analysis, (2) Staff, Parent, and Student Surveys, and a (3) Focus Group SWOT analyses. A concept survey included adults with hearing loss; professional adults who have worked with hearing loss children for at least one year (teachers, therapists, audiologists, and researchers); and, parents/guardians of hearing loss children. Findings provided very good support for building the prototype: 98.6% had positive initial reaction; 90.5% agreed the concept is unique; and, 93.2% perceived that it would be engaging for kids.

Results: A concept survey included adults with hearing loss; professional adults who have worked with hearing loss children for at least one year (teachers, therapists, audiologists, and researchers); and, parents/guardians of hearing loss children. Findings provided very good support for building the prototype: 98.6% had positive initial reaction; 90.5% agreed the concept is unique; and, 93.2% perceived that it would be engaging for kids.

Conclusion: The proposed study show good support for developing the game and proceeding with the pilot study.

Primary Author/Presenter: James Bilitski

Author Block: James A. Bilitski, Ph.D. Computer Science, Univ. of Pittsburgh at Johnstown, Johnstown, PA.

Learner Objectives:

Describe the research plan for the development and pilot study of a mobile game design.
Explain the concept of voice-pitch controlled gaming input.
Abstract Content:

Introduction: This study aims to show that a few adjustments in the therapy program towards age, mental, physical and auditory condition significantly improve music perception and overall auditory benefit, hence normal communication and social interactions can be found.

Methods: Subjects implanted with a CI 65 years or older were compared to age-matched normal hearing subjects. Questionnaires were administered before and after ten music therapy sessions, to evaluate the participant’s music habits, the perception of sound quality and self-awareness and hearing implant satisfaction.

Results: The greatest benefit was seen in participants’ gain in self-confidence and enjoyable music perception. Not only did the amount of listening to music increase, but also the impression of sound quality changed from poor up to good/very good sound quality.

Conclusion: The music therapy was well accepted and resulted in beneficial subjective as well as objective outcomes towards hearing and music impression, hence improved quality of life.

Primary Author/Presenter: Astrid Magele

Author Block: Astrid Magele, PD1, Bianca Wirth, Mag.2, Philipp Schörg, BsC.2, Georg Sprinzl, Univ. Prof. Dr.2;1ENT, Karl Landsteiner Private Univ. hospital, St.Poelten, Austria, 2ENT, Univ. clinic St.Poelten, KL Private Univ., St.Poelten, Austria.

Learner Objectives:

Music therapy improvement in Elderly CI recipients
Abstract Content:

Introduction: Attaining age-appropriate speech, language, and voice (SLV) skills is the principal goal for any young cochlear implant (CI) recipient. Besides several other factors, sound processing technology can also significantly impact CI individuals’ SLV outcomes. In this study, objective & subjective measures of speech perception, speech-language skills, voice, fluency, and articulation-phonological skills were obtained in CI recipients who are not currently undertaking formal speech language therapy (SLT) or have graduated from a CI rehabilitation program. The objective was to assess if these skills be impacted by introduction of new automatic noise-reduction algorithms over a period of six months.

Methods: Thirteen CI recipients (7 to 23 years; 12 children) who upgraded to next-generation sound processors were evaluated for the above mentioned SLV skills with the current versus older processors. Besides audiological measures (aided audiometry, SRT, WRS in noise, SSQ-12), measures of ‘maximum phonation duration’ (Voice - GRBASI), articulation, phonology, fluency were obtained. A developmental-milestones scale and a validated 30-point questionnaire were also used.

Results: A 5-10 dB improvement was noted in aided audiometry (0.25-6K Hz), a 26% improvement in WRS scores in noise, and a 5 dB improvement in SRT. Fronting & substitution of certain syllables (e.g., fronting of /ṯ/ self-corrected to voiceless velar stop /k/ and substituted palatalized /ṯ/ normalized to voiceless retroflex stop /ṭ/) appears to be reduced with fewer omissions. This could be because the individuals are able to leverage the improved audibility and SNR in their self-correction mechanisms. On the developmental scale, a lag in language & cognition categories by 3 years in children was noted at baseline. Vocabulary & expressive language had a spurt in 10/12 children with improvements in speech-intelligibility and articulation. Low-context questions were comprehended with greater frequency and accuracy. Voice was less nasal & more natural. Intonation, stress, rate-of-speech was more controlled and typical. Wireless streaming via Bluetooth & remote microphones enhanced comprehension of audio input in phone call and online communication. Participants required fewer repetitions in the conversations which enhanced their confidence.

Conclusion: Automatic front-end sound management, Bluetooth & wireless streaming can provide measurable and clinically relevant improvements in speech-language-voice skills in the real world amongst CI users.

Primary Author/Presenter: Smita Agrawal

Author Block: Aninda duti Banik, PhD, Masters in Audiology & SLP, PGDRePy, PGDDE1, Mithila Poonacha, MASLP2, Aravind Nair, MSC Audiology3, M. Divya, MSC SPEECH LANGUAGE PATHOLOGY4, Fatema Jagmaag, BASLP5, P. Sasidharan, MASLP4, Martina Brendel, Dipl.-Ing6, Smita Agrawal, PhD, POST-DOC, MASLP7;1AUDIOLOGY - CLINICAL EDUCATION RESEARCH, ADVANCED BIONICS INDIA PVT LTD, MUMBAI, India, 2HABILITATION, ADVANCED BIONICS INDIA PVT LTD, BANGALORE, India, 3AUDIOLOGY, ADVANCED BIONICS INDIA PVT LTD, KOCHI, India, 4SPEECH & HEARING, Dr. Manoj's ENT Super Specialty Inst. & Res. Ctr. - MESIARC, Kozhikode, India, 5SPEECH & HEARING, SHAABA SPEECH & HEARING CENTRE, MUMBAI, India, 6CLINICAL RESEARCH, Advanced Bionics GmbH-European Res. Ctr., Germany, HANOVER, Germany, 7CLINICAL RESEARCH, Advanced Bionic LLC, VALENCIA, CA.
Learner Objectives:

Compare speech perception, speech–language skills, voice, fluency, and articulation-phonological skills in Cochlear implant recipients

review if these speech & language skills are impacted by introduction of new automatic noise-reduction algorithms over a period of six months
Abstract Content:

Introduction: Approximately one third of children with cochlear implants have another disability in addition to hearing loss (Birman, et al 2012). Identifying appropriate schools for these children can pose a considerable challenge. Schools specializing in hearing loss are not always able to meet the multiply-involved child’s additional needs, but other special education programs may not have staff experienced in working with cochlear implant users. This presentation will consider this challenge through the lens of three families, describing their journeys from diagnosis to school placement, as well as each child’s subsequent progress with auditory, speech, language, and academic skills.

Methods: Following traditional cochlear implant candidacy, all 3 case study patients received cochlear implants. Each patient was evaluated by their school district to determine educational needs, including placement, related services, and accommodations, and these were written in an Individualized Education Program (IEP). Once placement type was determined, parents considered school options and made a selection. Progress with academic, speech, language, and auditory skills was tracked by school and medical providers.

Results: Three students attend school-age educational placements, which include: state school for the Deaf which specializes in students with multiple disabilities, state school for the Deaf with a BiBi philosophy, and a public school special education program for a variety of needs.

Conclusion: The Individuals with Disabilities Education Act (IDEA) guarantees every child in the U.S. a Free, Appropriate Public Education (FAPE). Yet, for parents of multiply-involved children with cochlear implants, access to a FAPE can be difficult to achieve. Even when school programs for children with hearing loss are available, these may not be able to accommodate and support children’s other needs. Greater collaboration between hearing loss professionals and those in the wider special education community is needed to improve outcomes for this population.

Primary Author/Presenter: David Spritzler

Author Block: David Spritzler, M.E.D., Blair Richlin, M.S. CCC-SLP, LSLS AVEd, TSSLD; The Ear Institute, New York Eye and Ear Infirmary, New York, NY.

Learner Objectives:

describe challenges involved in meeting the educational needs of children with cochlear implants and additional disabilities.

discuss the criteria for determining appropriate placement of children with cochlear implants and additional disabilities.
Counseling Parents of Cochlear Implant Candidates and Recipients on Realistic Expectations

**Abstract Content:**

Introduction: Cochlear implants have allowed thousands of children to achieve spoken language skills that would not have been possible otherwise (NIDCD, NCBI). However, outcomes are never guaranteed, and as candidacy criteria expand, so does the range of realistic expectations. Age of diagnosis, audiological history, age of implantation, etiology, comorbidities, and anatomical challenges, are all known to effect children’s success with a cochlear implant, and it is important for parents to develop realistic expectations for the device based on their child’s individual circumstances. Understanding and accepting the possibilities and limitations of their child’s cochlear implant can be a difficult task for families, and these challenges can be exacerbated by a variety of personal and social factors. In this presentation, we will discuss barriers to acceptance, and strategies for overcoming them, based on our clinical experience.

Methods: Case studies will be reviewed, including medical and social history, parents’ initial expectations prior to implantation, and changes over time. Barriers to acceptance, including parental education, language, socioeconomic status, cultural background, grief, guilt, and denial will be discussed. Strategies for supporting parents in understanding and accepting realistic expectations for their child’s cochlear implant, and their role and responsibility in the habilitation process will be shared.

Results: Despite counseling from professionals, many parents of cochlear implant recipients persist in believing that the device will be a “miracle cure” for their child’s hearing loss, or that their child will “beat the odds” and surprise clinicians by developing advanced spoken language skills despite known obstacles. These false beliefs can present a barrier to maximizing the device’s actual potential when parents become disappointed by what they perceive as a lack of progress following activation, affecting their ability to support their child in reaching achievable goals.

Conclusion: A direct, continuous, collaborative, multidisciplinary approach is the most effective method of supporting families of children with cochlear implants in developing realistic expectations for their child’s technology. Expectations and parental responsibilities should be explicitly discussed, and continuously reviewed by different team members, includingaudiologists, otolaryngologists, social workers, speech/language pathologists, and teachers. Information should be presented in different ways, including verbally and with written resources in the family’s native language, and adapted for the family’s specific ongoing needs. The parents’ crucial role in maximizing outcomes should be emphasized, and specific, achievable goals outlined and revisited on a regular basis.

**Primary Author/Presenter:** David Spritzler

**Author Block:** David Spritzler, M.E.D., Barbara Gordon, LCSW; The Ear Institute, New York Eye and Ear Infirmary, New York, NY.

**Learner Objectives:**

describe barriers to parental understanding and acceptance of realistic expectations for their child’s cochlear implant.
CI2023 Dallas: Cochlear Implants in Children and Adults
describe strategies for effectively counseling parents of children with cochlear implants about realistic expectations for the device.
Introduction: The auditory performance in noise of users of bimodal stimulation is still variable, therefore, it is necessary to present to the scientific community and to the population that uses acoustic stimulation associated with electrical stimulation the signal/noise ratio that encourage these individuals to listening comprehension.

Methods: 16 individuals participated in the study with a mean age of 42.1 years and a standard deviation of 26 years. All were submitted to the Hearing In Noise Test and Visual Analogue Scale, to quantify the level of “hearing effort”. The pre-surgical audiometry means of the non-implanted ear were collected.

Results: The average of sentence recognition in the fixed noise with the signal-to-noise ratio +10dB was 71.8%. In the adaptive noise condition the signal-to-noise ratio was +2.08dB. There was a statistical difference in the fixed noise condition when compared to bimodal stimulation and the Cochlear Implant. The mean on the Visual Analogue Scale was 2.63 in fixed noise and 5.43 in adaptive noise, however, without statistical difference. Individuals who averaged between 50 and 70 decibels performed better on the sentence recognition test.

Conclusion: The subjects had a positive mean signal-to-noise ratio in the recognition of sentences in noise, in addition to a good percentage in the fixed noise test with a signal-to-noise ratio +10dB.
Introduction: The infection with Covid-19 and its treatment can cause profound sensorial hearing loss and tinnitus, causing impacts on quality of life of these individuals. The objective is to report the auditory performance and quality of life after cochlear implant in a patient with severe Covid-19.

Methods: This is a case report and literature review. Was conducted on databases PubMed, BIREME, Scielo were searched using combined keywords: 'COVID-19,' 'SARS-CoV-2,' aural rehabilitation, 'hearing loss,' 'tinnitus.' No research was found with post covid patients who received a cochlear implant.

Results: J.T.G.N, male, Brazilian, 40 years old, PCR positive in February 2021, during 5 months of ICU he was intubated and evolved with hearing loss. He had no history of hearing loss or ear pathology. In October 2021, he underwent an audiological evaluation with tonal audiometry that revealed severe sensory hearing loss in the right ear and profound sensory hearing loss in the left ear. Speech discrimination scores were incommensurable bilaterally. Otoacoustic emissions and auditory brainstem response were absent bilaterally. Pre and post implant evaluations were done. The questionnaires dealt with quality of life (whoqol-bref), tinnitus (THI), and auditory qualities (SSQ-12). Pre-implantation questionnaire scores were Speech, Spatial and Qualities with a total of 0.25; Tinnitus Handicap Inventory with a total of 8, resulting in catastrophic tinnitus and; a quality of life questionnaire with a 66%. On March 12, 2022, he received simultaneous bilateral cochlear implant, and participates assiduously in auditory verbal therapy. After 3 months of activation he had Sentence recognition scores with Hearing In Noise Test of 100% bilaterally in silence condition (65 dB) and 99% in a fixed noise condition (55 dB with speech to noise ratio of +10). The Categories of auditory performance scale showed a category 7- ability to use the telephone. Questionnaires scores post-implantation were Speech, Spatial and Qualities with a total of 5,55; Tinnitus Handicap Inventory with a total of 25 and; a quality of life questionnaire with 75%.

Conclusion: Early rehabilitation with cochlear implantation allowed for improved speech understanding in quiet and noise, telephone use, and increased quality of life for the patient.
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: (Re)habilitation, Comprehensive Health Services, and Educational Aspects
Poster Exhibit Number: 105  Student Poster Competition? Yes

Abstract Number: 199
Poster/Abstract Title: Identifying Auditory Emotion Bio-Markers in Cochlear Implant Users with Machine Learning

Abstract Content:
Introduction: Cochlear implants have had tremendous success restoring a sense of hearing in the deaf. However, for cochlear implant users, emotion perception can remain challenging. Even after months of intensive rehabilitation, many cochlear implant users struggle with appreciating emotive tones in speech and music despite overall good speech comprehension. Failure to perceive emotional expression can result in maladjusted social behaviour and, in turn, impair their capacity to express emotions adequately, leading to detrimental socio-economic consequences. Recent advances in data analysis and automated pattern identification offer a means of comparing neuroimaging data associated with emotional processing beyond conventional analysis and could bring empirical support to developing training programs for emotion rehabilitation in cochlear implant users.

Methods: Hence, we used a machine learning approach to identify emotion-processing bio-markers in high-density electroencephalograms collected from cochlear implant users (n = 22) and matched normal-hearing controls (n = 22). Participants’ brain responses elicited by short musical and vocal emotional (happy, sad, and neutral) stimuli were used to train a random forest classification algorithm to help identify, in each group, the pattern of brain responses that can best predict the presented emotion.

Results: Using this machine learning approach, we were able to confirm the presence of emotion-specific patterns of brain activity in cochlear implant users despite the cochlear implant user’s reported emotion perception deficit.

Conclusion: The identification of these patterns brings forward evidence for implementing a rehabilitation program for emotion perception for this population; if an algorithm can differentiate aurally presented emotions, perhaps cochlear implant users can learn to discriminate emotions.

Primary Author/Presenter: Samir Gouin

Author Block: Samir P. Gouin, Bachelor of Science1, Sébastien Paquette, Ph.D.2, Alexandre Lehmann, Ph.D.3;1McGill Univ., Montreal, Canada, 2Department of Psychology, Univ. of Montréal, Montreal, Canada, 3Department of Otolaryngology, McGill Univ., Montreal, Canada.

Learner Objectives:
Discuss the potential for implementing rehabilitation programs for emotion-specific deficits in cochlear implant users and applying machine learning approaches to health data.

Compare the emotion-specific patterns of brain activity between cochlear implant users and normally hearing individuals.
Abstract Content:

Introduction: Adults who receive cochlear implants face challenges learning how to function using their implanted devices. Despite these known challenges, formal aural rehabilitation is not provided consistently across cochlear implant programs. Research in the area of adult aural rehabilitation is conflicted such that some studies show benefit for adults following formal rehabilitation (Ferguson et al., 2019; Fu et al., 2004) yet others show no benefits (Michaud & Duchesne, 2019). Clearly continued research is needed. The purpose of this study was to build on the existing literature by assessing an array of skills including speech perception, health related quality of life, self-perceived benefit, and communication confidence.

Methods: This was a retrospective analysis of existing data from a university based aural rehabilitation program. Data from medical records were mined from a total of 27 adults who received formal aural rehabilitation, either remotely or in person. Baseline and endpoint data was assessed using standard measures of speech perception in quiet (CNC words, AzBio sentences), self-perceived benefit, (Speech, Spatial and Qualities of Hearing Questionnaire; SSQ) health related quality of life (CI QoL), and communication confidence (Communication Confidence Profile; CCP). Following assessment, a customized formal aural rehabilitation program was provided. Sessions were scheduled for 50 minutes once a week for 20 weeks. Participants completed at least 80% of sessions. Each AR program was tailored to the participants goals and level of functioning.

Results: There were significant improvements found for speech perception and for the speech subscale of the SSQ. Of interest, some participants showed improvement in self perceived benefit, though no improvement in speech perception. Significant improvements in scores on the CI QoL and CCP were also found. These results are in line with previous research that gains in performance following formal aural rehabilitation are possible, though not uniform across participants.

Conclusion: Results of this study show that adults who receive cochlear implants generally benefit from formal aural rehabilitation. Performance improvement is variable.

Primary Author/Presenter: Douglas Sladen

Author Block: Douglas Sladen, Ph.D. Western Washington Univ., Bellingham, WA.

Learner Objectives:
The participants will be able to describe various service delivery models for adult aural rehabilitation.
The participants will be able to describe possible outcomes following adult aural rehabilitation.
Abstract Content:

Introduction: The aim of this review was to look at the evidence foundation of strategies used in Listening and Spoken Language (LSL) therapy. The objective was to build awareness of misconceptions and blind spots when explaining the evidence of the strategies to new LSLS candidates, to families, to inquire about dosage recommendations and to assess which strategies need to be further studied.

Methods: Studies mentioning 10 overarching strategy themes (e.g. qualitative/quantitative input, sensitive responsiveness) were selected and used to identify peer-reviewed studies that were published in the past 10 years. Over 150 keywords in English and in French were used to search 11 databases from the medical, behavioral sciences, educational and international domains. 3962 titles were identified, of these 392 were classified as relevant. 3 independent reviewers reviewed the abstracts using the Covidence software.

Results: 36 relevant peer reviewed full texts were deemed relevant. The most frequently mentioned strategies in the literature were the higher and lower-level facilitative language techniques which were identified in 22 studies. The least mentioned strategy was asking the child “what did you hear?”. Outcomes included qualitative/quantitative coding of audio/video samples, assessments scores, and parent reported outcomes. This was a heterogenous sample of studies as there were 11 types of comparisons. 33% of studies were carried out in school settings, 17% were conducted in a naturalistic environment such as the home. The validated Mixed Methods Appraisal Tool (MMAT) was used to rate the quality of the studies. Of the 4 randomized controlled trial studies identified, 1 had treatment fidelity measured, strategy dosage as part of the protocol, and interobserver agreement (Roberts et al. 2019). 1 had partial interobserver agreement (Kamble et al. 2020), 3 had full or partial blinding of the assessors (Roberts et al. 2019, Kamble et al. 2020, and Meizen-Derr et al. 2021), and 1 provided information on clinician/teacher training allowing for easy replication of the study (Roberts et al. 2019).

Conclusion: As the United States transitions from fee-for-service to a more value-based payment system it is critical for Speech-Language Pathologists to be cognizant of the approaches and strategies they use and their level of evidence. This review provides information on the evidence of the strategies used in LSL therapy as opposed to the evidence of the approach itself. Opportunities for the future: expanding the search beyond the 10-year mark and using multiple reviewers for rating the quality of the articles. This review suggests a need for more studies on parent-child interventions in the natural environment, more studies that include home language in the variables (as only 43% of the studies specified home language of population studied) and to include etiology as one of the variables when designing research questions related to strategies.

Primary Author/Presenter: Domitille Lochet

Author Block: Domitille Lochet, SLPD, CCC-SLP, LSLS Cert. AVToLaryngology, Univ. of Miami, Miami, FL.

Learner Objectives:

At the end of the session, participants will be able to list 3 types of comparisons identified in the studies on LSL strategies in the past 10 years.
CI2023 Dallas: Cochlear Implants in Children and Adults

At the end of the session, participants will be able to list at least 1 strategy that has been the most/least studied in the past 10 years and its level of evidence
Abstract Content:

Neural entrainment of a naturalistic conversation in varying working memory loads

Priyanka Prince1,2, Joseph Chen3,4, Trung Le3,4, Vincent Lin3,4, and Andrew Dimitrijevic1,2,3,4. 1. Evaluative Clinical Sciences Platform, Sunnybrook Research Institute, Toronto, ON Canada. 2. Department of Physiology, University of Toronto, Toronto, ON, Canada. 3. Otolaryngology—Head and Neck Surgery, Sunnybrook Health Sciences Centre, Toronto, ON, Canada. 4. Faculty of Medicine, Otolaryngology—Head and Neck Surgery, University of Toronto, Toronto, ON, Canada.

In a noisy environment with auditory and visual distractions, selective attention to target stimuli can be cognitively demanding especially in individuals with a hearing impairment or using a hearing protheses such as a cochlear implant (CI). CI users have been shown to rely more on visual input for the understanding of speech stimuli; this can result in an increased listening effort and therefore, more resources utilized from a limited cognitive load. The neural basis of this relationship between cognition and speech perception and understanding is not fully understood. In this study, using a high-density electroencephalogram (EEG) in normal hearing adults, we investigated the neural correlates of speech entrainment to two people having a conversation with background multitalker noise whilst visual digits appeared on the screen around them. The participant task was to answer conversation content questions and recall the digits that were presented. Three memory loads were assessed, no digits, three digits and seven digits. Behavioural results showed that as visual load increases, performance on recall for both the conversation and digits decrease. The degree of neural entrainment varied as a function of memory load such that larger memory load resulted in greater neural tracking. These data suggest that non-specific, cross-modality attention increases auditory-speech encoding. These data provide evidence that natural conversations be used as a stimulus when probing cognitive functions related to speech in noise listening and working memory.

Primary Author/Presenter: Priyanka Prince

Author Block: Priyanka Prince, MSc, Joseph Chen, MD, FRCSC, Trung Le, MD, PhD, FRCSC, Vincent Lin, MD, FRCSC, Andrew Dimitrijevic, PhD; Sunnybrook Res. Inst., Toronto, Canada.

Learner Objectives:

Describe the neural activity differences between CI users and NH controls when listening to a conversation.
Abstract Content:

Introduction: Digital technology has become an integral part of everyday life. Almost 99% of Australian’s over 18 years own smartphones. In 2020, 99% of Australians (65% globally), reported regular internet use. The internet is a significant source of health information, and digital devices are routinely used for telehealth services. Evidence suggests smartphone connected hearing devices, and digital hearing management programs can empower self-management of hearing loss and improve client outcomes. However, the use of these services remains underutilised. Digital literacy is the set of technical, cognitive and sociological skills individuals must possess to ensure efficient use of digital technology. Although options for integration of digital technologies into hearing clinics continue to rise, validated assessment of digital literacy is rare. Digital literacy measures often have many items and are not designed with older adults or those with hearing loss prohibiting clinical use. Subsequently clinicians may make incorrect assumptions about their clients level of digital literacy. The primary aim was to develop a short, one-two item, validated questionnaire to assess the digital literacy of adults with hearing loss in clinic.

Methods: A survey consisting of two digital literacy questions ‘How would you rate your skill level with a mobile device?’ and ‘How would you rate your confidence with a mobile device?’, the Mobile Device Proficiency Questionnaire (MDPQ-16) questionnaire, and demographic factors was developed. Adults ≥18 years, attending Western Australian audiology clinics, were invited to complete either an online (n=229) or a postal questionnaire (n=270).

Results: 111 completed questionnaires were received (48 email, 63 postal), mean age: 76.7 years (±8.1), better ear four-frequency average hearing loss (BE4FAHL) of 43.1 (±14.9 dBHL). Postal participants had poorer MDPQ-16 scores (p<0.001), fewer mobile devices (p=0.016), lower education levels, poorer hearing (p<0.05), and were more likely to be male (p<0.05). MDPQ-16 scores were not associated with BE4FAHL, but were moderately negatively correlated with age (r=-0.47, p<0.001). Notably 24% (n=22) of >70 year olds scored ≥ the median 50-70 year olds score, and 70% (n=64) ≥ 50% of the maximum MDPQ-16 score. Skill (p<0.05) and confidence (p<0.01) ratings were significantly lower for older adults but did not differ significantly for BE4FAHL. MDPQ-16 scores were significantly different across each skill ratings (p<0.001) and confidence each rating (p=0.002 to <0.001) except between “not confident at all” and “I usually need help”. Conclusion: Single-item mobile skill and confidence level questions were sensitive to mobile proficiency levels in the MDPQ-16 questionnaire. Thus, they can be used clinically to quickly assess digital literacy in adults with hearing loss. While digital literacy does decrease with age, clinicians should not assume all older clients have low digital literacy levels.

Primary Author/Presenter: Catherine Sucher

Author Block: Catherine M. Sucher, BSc DipAud MAud AuD1, Talveen Sahota, BSc2, Melanie Ferguson, PhD3;1Ear Sci. Inst. Australia, Subiaco, Australia, 2School of Human Sciences, Univ. of Western Australia, Crawley, Australia, 3Brain and Hearing, Ear Sci. Inst. Australia, Subiaco, Australia.

Learner Objectives:
CI2023 Dallas: Cochlear Implants in Children and Adults

To understand the importance of accurately measuring the level of digital literacy of adults when hearing loss when considering management options.
Introduction: The goal of this project was to create an online index of auditory training resources to ensure auditory training was accessible for CI professionals to recommend to patients. This project was two-folded: first, to compile smartphone and web-based applications and categorize them by features (e.g., environmental sounds, speech, music, cost, supported platform, etc.) Second, to create an online auditory training index where professionals “filter” the resources based on the features listed above for the patient’s individual training goals. This will assist CI professionals and patients in making the most appropriate selection for their training.

Methods: For the first part of this project, smartphone and web-based auditory training resources were collected from a review of public smartphone application stores, hearing aid and cochlear implant manufacturer websites and recommendations, and google searches. A total of 34 resources were compiled. Next, these resources were further analyzed and categorized by various features. These features include environmental sounds, speech (words, phonemes, sentences, discourse), with or without background noise, music (timbre, pitch contour, pitch matching), appropriate age (young children, adolescents/adult), platform available (Apple App Store, Google Play Store, website), cost (free, monthly subscription, or one-time payment), and monitoring feature availability. For the second and most critical part of this project, a user-friendly online index was created to assist professionals in their selection of these auditory training resources to recommend to patients. This will create a professional-guided auditory training plan for each patient’s individual goals and skill level. This online index allows professionals to “filter” through the resources based on the different features discussed above. Space for feedback from professionals will be available to ensure continued knowledge of new resources and specific resource reviews. The online index library of resources will be reviewed every three to six months to ensure only up-to-date resources are included and that new resources are added.

Results: The first part of the study has been completed: a full documentation of resources was created and can be accessed at https://bit.ly/aud_training_handout. The online index has been created and is being further improved. This allows professionals to filter through the large list of auditory training resources. An example is a recently implanted adult male having difficulty discriminating sounds in his environment. The professional can access the online index and click “adult,” “newly implanted,” “free,” “Apple App Store,” and “environmental sounds.” Based on the selection, a list of appropriate resources that match those features will populate automatically. This populated list allows a professionally-guided auditory training resource to the patient efficiently as well as monitoring of their auditory training.

Conclusion: This project compiled and analyzed auditory training resources and created a user-friendly online index to assist CI professionals when providing recommendations to patients. We hope that the online index can assist in making auditory training more accessible for the professionals and recipients, so that CI users can reach their full potential with their device.

Primary Author/Presenter: Olivia Adamson

Author Block: Olivia P. Adamson, B.A., Eun Kyung Jeon, Au.D., Ph.D.; Communication Sciences and Disorders, Univ. of Iowa, Iowa City, IA.
Learner Objectives:

Identify and compare current app-, web-based, and online auditory training programs based on various features for both pediatric and adult cochlear implant recipients.

Utilize the created online index of auditory training resources so that they can make auditory training more accessible for both professionals and recipients.
Abstract Content:

Introduction: Estimates have shown that more than 700 million people will suffer with disabling hearing loss by 2050, and it can have significant impact on individuals’ quality of life, professional occupation and social interactions. Aims: Assessing the impact of cochlear implants on quality of life, anxiety and depression improvement after surgery, based on validated questionnaires.

Methods: Thirty (30) adult, bilateral profound hearing loss carrier patients, recommended for Cochlear Implant surgery, were evaluated through the following questionnaires: World Health Organization - Quality of Life (WHOQOL-BREF) and Hospital Anxiety and Depression Scale (HADS), at four different moments, namely: pre-operative, 7 days, and 3 and 6 months after cochlear implant activation. Questionnaires ‘International Outcome Inventory Cochlear Implant (IOI-CI)’ and ‘Glasgow Benefit Inventory (GBI)’ were only applied 3 and 6 months after implant activation.

Results: Based on the anxiety and depression score analysis, there was decrease, either in anxiety or in depression values, throughout the 6-month follow-up in comparison to the pre-operative frame. This finding shows improvement in psychological disorders after the cochlear implant surgery; however, such data were not statistically significant. With respect to quality of life evaluated though WHOQOL-BREF, mean values recorded for the physical, psychological and social relationship domains did not present statistically significant changes throughout the follow-up period. Mean value recorded for domain ‘environment’ showed statistically significant increase at 6 months in comparison to the pre-operative frame. On the other hand, mean value recorded for quality-of-life self-assessment at 3 months has shown significant increase. Mean values observed for general health condition evaluation presented significant changes at 6-month follow-up. Regarding IOI-CI and GBI scores in our sample, they have shown that most patients were happy with the cochlear implant surgery.

Conclusion: Patients were happy with the cochlear implant surgery based on the IOI-CI and GBI questionnaires. Quality of life, anxiety and depression indices have improved after the cochlear implant surgery. Quality-of-life self-assessment, as well as the 'environment' and 'general' domains, recorded statistically significant improvement.

Primary Author/Presenter: Pauliana Lamounier

Author Block: Pauliana Lamounier, MD1, Victoria F. Gonçalves, MD1, Isabel C. Queiroz, MD2, Debora A. Gobbo, Aud1, Claudiney C. Costa, PhD1, Hugo V. L. Ramos, PhD1, Faye Bahmad Jr, PhD2;1Department of Otorhinolaryngology, Rehabilitation and Readaptation Ctr. Dr. Henrique Santillo (CRER), Goiânia, Brazil, 2Department of Health Science, Univ. Of Brasilia, Brasília, Brazil.

Learner Objectives:

Describe other benefits of cochlear implant surgery in addition to auditory rehabilitation, which are also involved in improving quality of life, such as improving depression and anxiety rates. At the end of the session, participants will be able to bette
I. Purpose
The primary aim of this project is to compare auditory and spoken language outcomes in patients that are positive for CMV and have developed hearing loss with children who have hearing loss unrelated to CMV.

II. Background
It is well established that children with hearing loss vary in terms of language outcomes; however, few studies have formally assessed language outcomes in children with hearing loss due to Cytomegalovirus (CMV). CMV is one of the leading causes of congenital hearing loss. There are an estimated 20,000 - 30,000 babies born with CMV in the US every year. According to the National CMV Foundation (2016), 90% of these babies are asymptomatic; however, approximately 10% - 15% will develop hearing loss within months or over several years. Children who have hearing loss due to CMV demonstrate a wide-range of long-term health issues and developmental delays – from hearing loss being the only disability to multiple involvement with global delays.

III. Subjects
Inclusion criteria: Patients aged newborn to 30 years of age that have been seen in the Pediatric Audiology program at EVMS and CHKD from January 1, 1995 to October 12, 2022 with a diagnosis of hearing loss due to CMV. Patients with hearing loss unrelated to CMV in the same age range will also be included as a comparison.

IV. Methodology
This is a longitudinal study to determine language outcomes of children with hearing loss due to CMV compared to children with hearing loss not due to CMV that have hearing aids or cochlear implants. Patients will be identified through a retrospective chart review of the electronic medical record system (EVMS AllScripts and CHKD Powerchart) along with paper records in patients aged newborn to 30 years of age seen in Pediatric Audiology clinics at EVMS and CHKD from January 1, 1995 to October 12, 2022. The number of qualifying patients by Inclusion/Exclusion criteria is expected to be 60: results for 30 children with CMV related hearing loss (15 with hearing aids and 15 cochlear implants) will be compared to results of 30 children with non-CMV related hearing loss (15 with hearing aids and 15 with cochlear implants). We will collect demographic data including age, gender, DOB and date of hearing aid fitting or cochlear implantation. Audiologic thresholds and speech perception scores will also be collected.

V. Data safety
Study personnel will enter data into a custom database designed by the Department of Otolaryngology – Head and Neck Surgery at Eastern Virginia Medical School. This data will be stored electronically with a password protected login. Only research coordinators and investigators involved in the study will be provided access. Strict patient confidentiality will be maintained at all times. Health Insurance Portability and Accountability Act (HIPPA) guidelines will be enforced. Data will be coded so that a relationship between it and subjects will be de-identified and the investigator and his staff will only have access to the database and the corresponding data key. The subject’s identity and all data collected for this study will be kept strictly confidential and will not be revealed in future reports or publications. Once the data analysis has been completed and published, the data key will be destroyed.

VI. Risk / Benefit Assessment
Subjects will not benefit directly from participating in this study, as this is a retrospective chart review of patients.

Primary Author/Presenter: Sarah Gunning

Learner Objectives:

Compare auditory and spoken language outcomes in patients that are positive for CMV and have developed hearing loss with children who have hearing loss unrelated to CMV.
Abstract Content:

Introduction: Early identification, amplification and intervention in children who are deaf/hard of hearing (D/HH) are associated with improved outcomes in many developmental areas. One area of development that has received little attention is speech articulation. Given the close link between speech articulation and perception, it might be hypothesized that speech articulation skills in children with hearing loss who are enrolled in specialized listening and spoken language programs and have received early diagnosis and intervention will develop on par with those of typically hearing peers. The purpose of this study was to evaluate this hypothesis in a group of 3- to 5-year-old D/HH children.

Methods: This analysis included data collected from forty-three 3- to 5-year-old D/HH preschool students who were enrolled in a specialized listening and spoken language program. As part of their educational programming, all children completed the Goldman-Fristoe Test of Articulation. For this analysis, only standard scores from the “sounds in words” subtest from children with at least 2 data points were included. Children with all degrees and configurations of hearing loss were included. The hearing assistive technology used included hearing aids (n = 21), cochlear implants (n = 17), and bone conduction devices (n = 4).

Results: On average, standard scores at age 3, 4 and 5 were below the range expected for children with typical hearing (age 3 (n=32): SS = 81.25, SD= 15.11; age 4 (n=40): SS = 82.4, SD = 17.44; age5 (n=14): SS = 81.64, SD = 16.73). Standard scores of children with CIs did not differ significantly from those of children with other hearing devices. Paired samples t-tests were conducted to examine change of speech articulation with age. No significant increases in speech articulation were found between age 3 and 4 [t (28) = -0.95, p = 0.3514], age 4 and 5 [t (11) = 0.55, p = 0.5902], or between age 3 and 5 [t (6) = 0.08, p = 0.9376], regardless of hearing device used. When dividing children by their initial score, the group of children who had a standard scores below the range expected for typically hearing children showed a significant increase in standard scores between age 3 and 4 [t(18) = -2.19, p = 0.0420] but not between age 4 and 5 [t(6) = -1.13, p = 0.3095].

No differences in standard score were observed for children with initial scores in the range expected for children with typical hearing.

Conclusion: This analysis replicates earlier findings that, on average, speech articulation skills in children with hearing loss are delayed compared to their typically hearing peers. This pattern is observed despite intensive interventions and consistent use of hearing technology. Although average speech articulation skills did not improve significantly between age 3 and 5 in this group of children, significant increases in speech articulation were observed for 3-year-old children whose initial speech articulation scores were below the range expected for children with typical hearing. This may indicate that young children with speech articulation delays are closing the gap while children with speech articulation scores in the typical range maintain their skills. No differences were observed in children with CIs compared to children with other hearing technology. This finding may have been due to the small sample size and should be re-evaluated in future studies. In addition, future work should evaluate predictors of speech articulation outcomes to better guide interventions.
Learner Objectives:

describe speech articulation skill development in preschool-aged children who are D/HH
Abstract Content:

Introduction: Adolescents with cochlear implants (CI) experience significantly more peer problems, lower peer acceptance, and higher rates of peer victimization than peers with typical hearing (TH). These negative outcomes may result from effects of hearing loss on social skills, but a link between hearing and social communication has not been established. This project explores if auditory status affects emotion and social cognition in adolescents with CI and with TH.

Methods: Participants include 17 adolescents with long-term CI use (M=13.8 years) and 32 adolescents with TH (M=13.7 years). All participants completed (a) the pragmatic subtest of a formal language test; (b) an online survey including measures from the Emotion Domain of the NIH Toolbox for Assessment of Neurological and Behavioral Function (NIHTB) (i.e., social relationships); and (c) tablet-based measures of emotion recognition and social perception from the Pediatric Evaluation of Emotions, Relationships, and Socialization (PEERS).

Results: Auditory status did not affect emotion recognition ability. The TH group achieved significantly higher accuracy and faster response time than the CI group on the social perception task (p<.05). On the NIHTB Emotion measures, the TH group reported (a) significantly more positive ratings of friendship and emotional support; and (b) significantly lower levels of perceived rejection compared to the CI group (p<.05). No significant group differences emerged on the NIHTB loneliness instrument. Measures of social communication significantly correlated with pragmatic skills and ratings on the social relationship questionnaires (p<.05).

Conclusion: Adolescents with CIs exhibit poorer social perception and social-pragmatic skills and report significantly less positive social relationships compared to peers with TH. These results provide the first step toward development and implementation of evidence-based therapy targeting risk and protective factors to effectively reduce social communication deficits in adolescents with CI.

Primary Author/Presenter: Andrea Warner-Czyz

Author Block: Andrea Warner-Czyz, Ph.D.1, Julia Evans, Ph.D.1, Lyn Turkstra, Ph.D.2;1Speech, Language, and Hearing, The Univ. of Texas at Dallas, Dallas, TX, 2McMaster Univ., Hamilton, Canada.

Learner Objectives:

Recognize similarities and differences in social communication by auditory status

Describe risk and protective factors related to social communication and social relationships in adolescents with cochlear implants and adolescents with typical hearing
Introduction: Cochlear implant (CI) clinics routinely manage clients via a fixed schedule of in-person appointments. Personalisation of these services is limited. Regular review of CI function is vital to ensure optimal hearing and implant integrity, but can at times result in costly and time-consuming appointments of limited practical benefit for the clinic and CI user alike. Projected increases in CI uptake suggest that in order to provide relevant and efficient life-time support to CI users alternative service provision options must be considered. Remote Check is an asynchronous digital CI management tool that facilitates home review of CI function. This study evaluated the acceptance, accuracy and implications of using a remote CI review tool for long-term adult CI users an adult CI clinic.

Methods: Remote Check outcomes measures included Aided Thresholds (ATT), Digit Triplet Test (DTT), Speech and Spatial Qualities (SSQ12) Questionnaire, and impedance checks. Reviews were completed at baseline (in clinic), 1 week, 1 month and 6 months (home-based). Standardly used clinic outcomes measures, CNC words (in quiet), Aided Thresholds (free field) and impedances (programming software) were recorded in clinic at baseline. Ease of use, and participant acceptability were reviewed following each Remote Check review. Clinic metrics relating to clinician time allocated to participants across the 6-month period were recorded.

Results: Fifteen adults, (mean age 63.8 years ±15.0) participated. Of the 57 reviews completed half (52.6%) required no further action, 26% reviews led to offer but not acceptance of a clinic, 7% resulted in additional remote monitoring of the implant site. Clinical appointments were required after 8.8% of reviews. On average remote check reviews took 5.69 min (±5.62). Remote check and in-clinic baseline impedance levels were not significantly different. Aided thresholds were not significantly correlated with ATT levels. Strong but non-significant associations were seen between DTT score and CNC phoneme score; (1st CI ear: \( r = -0.544, p=0.044 \), 2nd CI ear: \( r = -0.802, p=0.030 \)) following adjustment for multiple comparisons. Significant strong positive correlations were seen between DTT scores at baseline and 1 week (\( r = 0.852, p <0.001 \)). ATT and DTT scores improved slightly, but not significantly over time. SSQ-12 scores and Remote Check impedance levels did not change over time. Over all time points, ≥ 80% of participants found Remote Check very easy/somewhat easy to use accept ≥ 93% were likely to accept future remote check reviews.

Conclusion: Remote Check can effectively provide an alternative option to traditional long-term CI review and facilitate increased clinic capacity but does not replace all clinical needs. Implementation on a wider scale must be carefully considered both in regard to clinician and client acceptance, ability to track outcome measures over time, funding considerations, personalisation and optimisation of care.

Primary Author/Presenter: Catherine Sucher

Author Block: Catherine M. Sucher, BSc DipAud MAud AuD, Denise Howting, B Nursing, BSc, M Public Hlth, M Med Stats, Lize Coetzee, BSc, MAud, PostGrad Dip Bus, Melanie Ferguson, PhD; Ear Sci. Inst. Australia, Subiaco, Australia.

Learner Objectives:
Define implications of use of remote CI review technology in CI clinics
Abstract Content:

Introduction: Sudden sensorineural hearing loss (SSNHL) is a rare manifestation of the neuroinvasive novel coronavirus 2019 (COVID-19). Cochlear implantation (CI) has been reported once for definitive management of COVID-19 related single sided deafness (SSD) in an adult. Our aim is to present the first cases of pediatric cochlear implantation for presumed COVID-19 related SSD.

Methods: Patients under 18 were included who underwent cochlear implantation following SSNHL after presumed COVID-19 infection via retrospective review. Literature review was performed as a general search on Pubmed for “cochlear implant” and “COVID-19”.

Results: A 6-year-old female (patient A) and a 13-year-old male (patient B) met inclusion criteria. Patient A’s pre-operative word recognition score (WRS) and speech awareness threshold (SAT) in the affected ear were 0% at 100 dB HL and non-responsive, respectively. She underwent right CI 10 months post-infection via round window insertion with a slim modiolar electrode; her SAT improved post-operatively to 20 dB HL at 3 post-operative months. For patient B, audiogram showed profound SNHL in the left ear; pre-operative WRS and SAT were 20% at 100 dB HL and 90 dB HL, respectively. The patient underwent CI 9 months post-infection via round window insertion of a slim modiolar electrode; SAT for patient B improved to 25 dB HL at 2.5 months after surgery. Neither patient suffered from intra- or post-operative complication. Both patients and their caregivers reported benefit and were using their implant for increasing hours.

Conclusion: Single sided deafness is a rare neurological complication from COVID-19 infection which can occur after mild cases. CI is a valuable tool for restoring hearing localization and awareness in this clinical scenario. Early success with these first cases demonstrates technical feasibility and benefit with this definitive management of pediatric COVID-19 related SSD.

Primary Author/Presenter: Kaitlyn Brooks

Author Block: Kaitlyn A. Brooks, MD, Kristan Alfonso, MD, Nandini Govil, MD; Emory Univ., Atlanta, GA.

Learner Objectives:

Discuss cochlear implantation as a definitive tool to treat pediatric post-COVID-19 single sided deafness
Abstract Content:

Introduction: How old is too old for cochlear implantation (CI)? This question will become increasingly relevant as complications of undergoing elective surgery are weighed against benefit of implantation for extreme elderly adults. We present our experience of patients 90 years and older undergoing CI at a tertiary care center. Methods: A retrospective review and survey were performed. Patients 90 years and older at time of CI were included. Speech discrimination scores (SDS), speech recognition threshold (SRT), post-operative complications (surgical and medical), and quality of life (QOL) documentation with CI QOL-35 were collected as outcome measures. All patients were surveyed in regards to perceived benefit in their daily life. Results: Inclusion criteria yielded 6 patients (5 M, 1 F, ages 90 - 94 years at time of surgery) for a total 6 ears implanted. Pre-operative median SRT and SDS were 80 dBHL (range 45 - 100 dBHL) and 12.5% (range 0 - 48%), respectively. Median post-activation best SRT was 30 dBHL (range 25 - 90 dBHL); median post-activation SDS was rather low at 8% (range 0 - 28%). Two patients died 13- and 25-months post-implantation. No patients suffered from medical or surgical peri-operative complication. Two patients reported little or no subjective benefit after CI; 3 patients reported significant benefit (n=5). Median pre-activation CI QOL-35 raw scores (n=3) were 14 and 18 for communication and global domains, respectively. One patient experienced a 7-point increase in post-activation communication domain (n=1). Median follow-up was 17 months (range 3 - 52 months). Conclusion: Cochlear implantation in the extreme elderly population is safe. While post-activation SDS may be poor for these patients, benefit of cochlear implantation at this age seems to be highly individualized. Pre-operative assessment for which patients will experience significant benefit will require further investigation.

Primary Author/Presenter: Kaitlyn Brooks

Author Block: Kaitlyn A. Brooks, MD, Esther X. Vivas, MD; Emory Univ., Atlanta, GA.

Learner Objectives:

At the end of the session, participants will be able to discuss audiological and quality of life outcomes for patients 90 years and older undergoing cochlear implantation
Abstract Content:
Introduction: Auditory neuropathy spectrum disorder (ANSD) is characterized by normal cochlear function and impaired auditory neural transmission. Individuals with ANSD have difficulty perceiving and localizing sound out of proportion to what is expected based on their pure tone average (PTA). While cochlear implants (CI) have been established as a promising treatment option for the patients, a significant subset are not considered for treatment with CI due to normal or near normal hearing levels on audiology. The objective of this presentation is to describe the preoperative decision making, intraoperative electrocochleographic (ECoG) findings, and outcome of CI in a patient with ANSD and normal pure tone thresholds.

Methods: This is a case report describing our findings of CI in a patient with ANSD and normal PTA. The patient was a 19-year-old with a history of hypoxic ischemic encephalopathy and seizures was referred for hearing rehabilitation in the setting of typical hearing by pure tone audiometry but poor speech understanding. A diagnosis of ANSD was made based on auditory brainstem response (ABR), distortion product otoacoustic emissions (DPOAE), and acoustic reflex testing. Imaging revealed no central cause of hearing impairment. The patient was implanted with a right sided CI. Pre- and postoperative audiometric data and intraoperative ECoG were collected.

Results: Preoperatively the patient underwent comprehensive audiological testing with behavioral audiometry, ABR testing, and CI candidacy evaluation. In the right ear, the PTA was 15 dB and word recognition score (WRS) was 36%. ABR confirmed ANSD. Preoperative CNC and AzBio in quiet were 8% and 0%, respectively. Intraoperative ECoG amplitudes and audiometry showed responses in the 100 µV range and estimated PTA of 42 dB HL. Postoperative testing at 1-month post-initial activation revealed PTA of 45 dB HL and unchanged word and sentence scores. However, the patient cites an improved ability to communicate and increased confidence and averages over 14 hours of device use daily.

Conclusion: To our knowledge this is the first case detailing the use of CI in an ear with normal PTA. Given that nearly all presently available ECoG data comes from patients with greater degrees of hearing loss, this unique case adds to our understanding of hearing preservation in CI.

Primary Author/Presenter: Anna Buhle

Author Block: Anna Buhle, BS1, Hilary McCrary, MD2, Steve Gordon, MD2, Kathryn Johnson, AuD, CCC-A2, Eric Babajanian, MD2, Neil Patel, MD2;1Virginia Tech Carilion Sch. of Med., Roanoke, VA, 2Otolaryngology - Head and Neck Surgery, Univ. of Utah, Salt Lake City, UT.

Learner Objectives:
At the end of the session, participants will be able to define auditory neuropathy spectrum disorder and state challenges that arise in treating these patients.
CI2023 Dallas: Cochlear Implants in Children and Adults

At the end of the session, participants will be able to describe how outcomes are measured in cochlear implant and discuss methods for improving these metrics.
Introduction: Cochlear ossification or otherwise known as labyrinthitis ossificans is a frequent indication of cochlear implantation, that may necessitate alternative surgical approaches due to anatomical difficulties. We aimed to review the literature to find the documented approaches for cochlear implantation in an ossified cochlea.

Methods: This review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Articles that described their surgical approach to the RW were included. The PubMed, Scopus, Web of Science, and Cochrane Library electronic databases were searched. The study protocol was registered on PROSPERO.

Results: The following approaches were found after the literature review: the standard facial recess/round window approach, partial insertion technique, use of short electrode, scala tympani cochleostomy, scala vestibuli cochleostomy, double/split array electrode use, drill-out procedure, subtotal petrosectomy, and alternatively use of brain-stem implantation.

Conclusion: This review suggests that there are numerous distinct approaches for cochlear implantation in an ossified cochlea, providing alternative approaches when the RW is inaccessible through the standard facial recess approach. The proposed algorithm in this article can guide the surgeons in decision-making.

Primary Author/Presenter: Isra Aljazeeri

Author Block: Isra A. Aljazeeri, Fellowship trained consultant otology neurotology1, Sajidah Alturaiki, MD1, Abdulrahman Hagr, Professor2,1Otology, Ministry of health, Houfuf, Saudi Arabia, 2Otology, King Saud Univ., King Abdullah Ear Specialist Ctr., Riyadh, Saudi Arabia.

Learner Objectives:

To learn about all the approaches used to implant an ossified cochlea.

To illustrate the algorithm for choosing the right approach in cases of labyrinthine ossificans.
Introduction: Cochlear implants have created a paradigm shift in the treatment of sensorineural hearing loss. The contributions of scientists and doctors in the past decades have served as building blocks in laying the foundation of cochlear implant surgery, even in patients with inner-ear malformations. Although most implanted patients have normal gross temporal bone anatomy, Jensen has estimated that 20 per cent of children with congenital sensorineural hearing loss (SNHL) will have some inner-ear abnormality. One of the most common cochlear abnormalities seen in cochlear implant surgery patients is Mondini dysplasia, as described by Carlo Mondini in 1791. This inner-ear abnormality appears at about the seventh week of gestation. The auditory or vestibular function may range from normal to severely impaired. Silverstein and colleagues were the first to implant a multichannel cochlear implant in a patient with Mondini dysplasia, in a 31-year-old man. Although several studies have shown a clear benefit of cochlear implantation in patients with Mondini dysplasia, there are relatively few reports of the benefits over a long period. This study aimed to: (1) evaluate the complications encountered intra-operatively in patients with Mondini dysplasia (2) assess the development of auditory skills post-implantation in young children with Mondini dysplasia (3) compare the auditory skills of children with Mondini dysplasia and profoundly deaf children with radiologically normal inner ears.

Methods: A retrospective survey was carried out of 338 patients with severe to profound sensorineural hearing loss who underwent cochlear implant surgery from February 2015 to May 2017. Patients were divided into 2 groups of 27 patients each. Both groups were followed up to three years post-implantation.

Results: Cerebrospinal fluid ooze developed in 12 patients, and 2 patients had a cerebrospinal fluid ‘gusher’, one of which had to be explored within 24 hours. After implant use for one year, both groups had similar speech perception scores.

Conclusion: The cerebrospinal fluid gusher in Mondini dysplasia should be anticipated and adequately managed intra-operatively. This study highlights the tailoring of a post-implantation rehabilitation program according to individual needs.

Primary Author/Presenter: Neeraj Suri

Author Block: Neeraj Suri, MBBS, MS. ENTOTORHINOLARYNGOLOGY, GMERS MEDICAL COLLEGE & HOSPITAL, GANDHINAGAR, GANDHINAGAR, India.

Learner Objectives:

This study details the intra-operative complications, and compares auditory scales post-implantation of either profoundly deaf young children with radiologically normal inner ears (group A) or children with Mondini dysplasia (group B).
Abstract Content:

Introduction: In response to parental frustration with the hearing loss evaluation and lack of access to cochlear implantation, we established in 2006 a multidisciplinary hearing loss center comprised of a pediatric geneticist and otolaryngologist to provide an integrated approach to improve childhood hearing loss evaluation. Since then, we have grown to include a genetic counselor, clinic coordinator, audiology and other subspecialists (e.g. infectious disease, neurology and ophthalmology) to ameliorate the diagnostic odyssey and facilitate treatment. In addition, one of the providers began to perform cochlear implants in 2020. In this presentation, we propose to describe how the clinic is run, and provide examples how this integrated approach can facilitate cochlear implant candidacy. Methods: Retrospective review of our collective experience from the Hearing Center. We will present outcomes from over two hundred children evaluated between 2020-2022 focusing on the outcomes of those with congenital cytomegalovirus (cCMV) infection or with genetic mutations. Results: During this period, sixty-two children were diagnosed with probable or confirmed cCMV infection. Eighteen had severe symptomatic cCMV disease. Two with less severe cCMV infection underwent cochlear implantation. Twenty-one children were diagnosed with a genetic mutation. Three (2 with connexin and 1 with TMPRSS3) underwent cochlear implantation. The clinical course of these children will be presented to highlight advantages found when the etiology of their hearing loss was determined. Conclusion: A multidisciplinary clinic that integrates hearing loss evaluation and treatment may improve cochlear implant accessibility.

Primary Author/Presenter: Torrey Fourrier

Author Block: Torrey L. Fourrier, MD1, Pamella Black, AUD2, Abdallah Elias, MD3, Albert Park, MD3;1Department of Otolaryngology Division of Pediatric Otolaryngology-Head and Neck Surgery, Univ. of Utah, Salt Lake City, UT, 2Primary Children’s Hosp., Salt Lake City, UT, 3Univ. of Utah, Salt Lake City, UT.

Learner Objectives:

Explain the value of a Multidisciplinary hearing center focused on the evaluation and treatment of permanent hearing loss.

Describe how this hearing center can facilitate cochlear implant candidacy.
Abstract Content:

Introduction: Since there is great confusion in the literature about the anatomy and terms of the crista fenestra (CF) and the crista semilunaris, this paper is confined to the anatomy of the inferior margin of the round window (RW). Methods: height of the RW and the maximum height of the inferior bony edge of the RW, (termed CF type A), in this study. The ratio of the maximum height of CF type A to the maximum height of the RW was calculated. After drilling the CF type A, the scala tympani was visualized using a sialendoscope, and any bony projection in the inferior wall of the scala tympani just behind the round window membrane (RWM) was assessed and reported (termed CF B in this study). Results: We identified CF type A in 19/20 of cases (95%), and it was absent in only 1 case (5%). Its height ranged from 0.228 to 1.329 mm with an average of 0.604±0.347 mm. The percentage of CF type A to RW ranged from 19 to 75%, with an average of 42%. CF type B was present in only 2 specimens (10%). Conclusion: CF type A occupied a significant part of the RW in most specimens, and therefore its drilling was essential in a large percentage of cases. CF type B (inside the scala tympani) was present in 10% of the temporal bone samples, and curettage had to be done in these cases.

Primary Author/Presenter: Ahmed Mehanna

Author Block: Ahmed A. Mehanna, Doctorate degree Otolaryngology, Alexandria school of medicine Egyp, ALEXANDRIA, Egypt.

Learner Objectives:

we have identified two bony prominences in the inferior area of RW. The first one represented the anteroinferior overhang of RW. It was termed the CF type A and it was present in 95% of temporal bone specimens. It occupied a significant part of RW in 58
Introduction: Objectives/Hypothesis: A retrospective study to evaluate the clinical, electrophysiologic findings, the management plans of the misplaced cochlear implant electrode array and the possible causes of misplacement. Also to provide re-commendations to prevent a repeat of cochlear implant electrode misplacement into abnormal sites.

Methods: Methods: Pediatric cochlear implant recipients implanted from January 2012 till January 2018 whose electrode arrays were misplaced outside the cochlea into the surrounding structures. Results: Results: Eight pediatric cochlear implant recipients, were identified to have a misplaced cochlear implant electrode array. Different sites of improper placement included one case in the eustachian tube, another one in the vestibule, one electrode array was found to be in the petrous apex lateral to the internal carotid canal, and another one in the internal auditory canal (IAC), and in three cases the electrode arrays were packed in the hypotympanum, and lastly an electrode array recoiled after perfect insertion and was found to be in the facial recess. Six cases were initially identified immediate because of their poor intraoperative implant testing which prompted imaging while in two cases, the one found in the petrous apex and the other one in the internal auditory canal (IAC) were diagnosed several months after surgery due to unsatisfactory auditory skills development or absent behavioral responses following implantation.

Conclusion: Conclusions: Electrode array misplacement may be due to either failure to identify the anatomical landmarks during surgery specially the infracochlear air cell track or unidentified inner ear malformation. The routine use of intraoperative electrophysiologic testing and postoperative imaging should help to avoid such complications. Misplacement is a rare but still correctable complication after cochlear implant surgery. The diagnosis of misplacement can be delayed for years and in this occasion, it is suspected when benefit from the implant is limited or absent. Once misplacement is diagnosed revision surgery has to be done.

Primary Author/Presenter: Ahmed Mehanna

Author Block: Ahmed A. Mehanna, Doctorate degree Otolaryngology, Alexandria school of medicine Egyp, Alexandria, Egypt.

Learner Objectives:

Electrode array misplacement may be due to either failure to identify the anatomical landmarks during surgery, or unidentified inner ear malformation. The diagnosis of misplacement can be delayed for years and in this occasion, it is suspected when benefit from the implant is limited or absent. Once misplacement is diagnosed revision surgery has to be done.

When misplacement is suspected immediate postoperative plain xray (Stevens position) has to be order, so as to confirm or rule out the diagnosis, once confirmed, HRCT scan and revision surgery have to be done.
Abstract Content:

Introduction: The purpose of this poster is to describe the cases of two infants with the Chudley-McCullough syndrome who underwent successful bilateral cochlear implantation. The Chudley-McCullough syndrome is described and literature is reviewed.

Methods: Case series with report of the literature.

Results: We describe an 18 month old male and 22 month old female who underwent uncomplicated simultaneous bilateral cochlear implantation at 12 and 15 months, respectively. Both patients presented to the cochlear implant center after referred newborn hearing screen and both patients failed a trial of traditional amplification. Postoperative speech and language development is satisfactory at 6 and 7 months respectively after implantation.

Conclusion: Cochlear implants in young children with Chudley-McCullough syndrome is safe and efficacious. Despite extensive intracranial anomalies, these children are good candidates for early cochlear implant.

Primary Author/Presenter: Noah Alter

Author Block: Noah Alter, Medical Student, Class of 2025, Samuel Ostrower, MD; Pediatric Otolaryngology - Head & Neck Surgery, Joe DiMaggio Children's Hosp., Hollywood, FL.

Learner Objectives:

Identify the clinical features of the Chudley-McCullough Syndrome

Define the role of cochlear implants in Chudley-McCullough Syndrome
Introduction: Cochlear implants have become the standard of care for patients with significant hearing loss who no longer benefit from conventional amplification. As candidacy criteria continue to expand, the ability to monitor electrode insertion and preserve the delicate cochlear structures becomes vitally important. Preservation of the cochlear structures is well known to correlate with hearing and speech understanding outcomes. Historically, conventional cochlear implant electrode insertion has provided the surgeon with no feedback as to whether these structures have been preserved. One means of achieving this feedback is through the use of electrocochleography (EcochG). EcochG is an electrophysiologic reflection of peripheral acoustic-electric interactions within the cochlea. With EcochG measurements, the functional integrity of different elements of the peripheral auditory system can be examined. Using EcochG, behavioral hearing thresholds can be estimated with an accuracy of +/- 10 dB HL. Methods: This is a retrospective study design using the data from our Center for patients who receive an Advanced Bionics implant and undergo routine EcochG testing intraoperatively and postoperatively from 2020-2023. Patients are at least 1 year of age or older and have thresholds of ≤ 80 dB HL at 500 Hz on preoperative testing are included in this review. Routine EcochG data collected during surgery and postoperatively will be assessed. Pre-and postoperative behavioral audiometric thresholds will be reviewed. Long term patient outcomes will be reviewed in relation to EcochG responses. Test data is typically gathered at 3, 6 and 12 month intervals. Results: Charts for patients who received an Advanced Bionics cochlear implant and had routine EcochG measures performed during electrode insertion will be reviewed. This will include ongoing EcochG measures obtained postoperatively, as well as behavioral audiograms and word and sentence test measures. Conclusion: Expected findings include: 1: Changes in the EcochG signal during electrode insertion will correlate with post-operative audiograms. 2: Modification of insertion speed and trajectory of electrode can recover the EcochG response and improve postoperative hearing preservation in the implanted ear. 3: Postoperatively, changes in the EcochG signal over time will correlate with changes observed in in postoperative audiograms over time. 4: Intraoperative preservation of the EcochG signal will correlate with postoperative scores on standardized speech testing.
Introduction: The round window of the cochlea is the main gate for scala tympani for cochlear implant surgery. Visibility and accessibility to round window via drilling facial recess may be difficult or even sometime impossible. We try to count different methods to access round window in CI surgery depending on our own experience over several years.

Methods: Revising our publications and our experiences over years in the RW visibility and accessibility

Results: Growing experience in predication of visibility and accessibility of RW by using computed tomography of petrous bone in special cuts

Conclusion: We can predict the difficulty of RW visibility by special cuts by CT scanning.
**CI2023 Dallas: Cochlear Implants in Children and Adults**

*Poster Exhibit Abstract*

**Poster Category:** Surgery/Medical

**Poster Exhibit Number:** 57  
**Student Poster Competition?**

**Abstract Number:** 64

**Poster/Abstract Title:** Preoperative Assessment of the CT scan & MRI of the temporal bone in finding out the degree of difficulty in cochlear implant surgery

**Abstract Content:**

&lt;u&gt;INTRODUCTION -&lt;/u&gt; Cochlear implants (CIs) are a well-accepted treatment for severe-to-profound sensorineural hearing loss patients who do not get benefit from hearing aids. Imaging plays an important role in the workup of CI candidates to identify inner ear congenital abnormalities. Both computed tomography (CT) and magnetic resonance imaging (MRI) should be done to study cochlear and middle ear anatomy which help the surgeon to cruise better during surgery.  

**METHODOLOGY**

For Retrospective Group Waiver of consent from ethical committee was used to access the patient data from hospital records for retrospective data collection. For Prospective Group the detailed information about the study explained to the patients found eligible for inclusion in the study. Informed consent taken from all of them. Scientific and ethical committee clearance was obtained for the study. Preoperative HRCT and MRI scan of temporal bone studied for the retrospective group and the prospective group. HRCT technique for preoperative scan: CT scans were performed on SIEMENS SOMATOM DEFINITION edge 128 slice dual energy with following parameters: collimation: 128x0.625, slice thickness: 0.67 mms, increment: 0.33 mms, reconstruction algorithm: 360, rotation time: 0.5 s, pitch factor: 0.426 and image display matrix: 768x768. MRI technique for preoperative scan: MRI imaging of the patients was performed on a “3Tesla GE discovery 750 MRI” using a neurovascular or head coil. After a localizer series the standard protocol consists of the following sequences: Diffusion sequence T2 axial sequence, T2 FLAIR axial sequence, T1 cor, T2 cor, T1 SAG sequence, axial T2 FIESTA sequence through the inner ear with slices as thin as 0.4 mm and oblique T2 BFFE sequence. All HRCT and MRI images were examined in axial planes parallel to the lateral semicircular canals' long axis. Coronal sections were viewed perpendicular to the plane of the axial pictures. An expert in head and neck imaging evaluated each of the preoperative imaging modality.

**Results**

Ninety patients were evaluated in the study. The population included 40 female subjects (44.4 %) and 50 male subjects (55.6 %) with a mean age of 7.3 years (1 year to 64 years). All ninetypatients underwent cochlear implantation by the same implant surgeon. The surgical time required in each case was documented from skin incision to skin suture completion. The surgical time for all ninety patients ranged from 45 to 220 min with mean time 103 min. Each imaging point was correlated with the surgical timing. Total potential difficulty score derived from imaging studies ranged between 0 to 5 with mean score 1.2. A linear relationship was observed between increasing potential difficulty score and correspondingly increasing operative times. We found a statistical significant correlation between potential difficulty score and the surgical time.

**Conclusion**

The cochlear implant surgical planning is based on HRCT and MRI findings about the anatomy of the temporal bone and cochlea. In order to prepare surgeons for potential issues and challenges they may face during the surgery, the authors developed a 10-point score chart and grading system based on imaging. After grading the pre-operative imaging examinations based on the scoring system, the authors concluded that there is a statistical significant linear relationship between increasing potential difficulty score derived by preoperative CT and MRI and the increasing surgical time.

**Primary Author/Presenter:** Sumit Mrig
CI2023 Dallas: Cochlear Implants in Children and Adults

Author Block: Sumit Mrig, MBBS, MS ENT, DNB, MNAMS1, Ravi Shankar Dhakar, MBBS, DNB2, Richa Bansal, MBBS, MD2; 1DEPT OF ENT & COCHLEAR IMPLANT SURGERY, MAX SMART SUPER SPECIALITY HOSPITAL, NEW DELHI, India, 2DEPT OF RADIODIAGNOSIS, MAX SUPER SPECIALITY HOSPITAL, NEW DELHI, India.

Learner Objectives:

preoperative evaluation of ct scan & MRI scan

correlation of the scan findings to assess degree of difficulty in cochlear implant surgery
Management of facial nerve stimulation after cochlear implantation: A systematic review

**Introduction:** Management of facial nerve stimulation after cochlear implantation: A systematic review

**Objectives:** To review and report the effective management techniques that have been used to control and minimize the facial nerve stimulation (FNS) after the cochlear implantation (CI).

**Methods:** A comprehensive electronic search strategy was conducted to identify relevant articles through the related databases, including Web of Science, Scopus, PubMed, Cochrane Library, and Virtual Health Library (VHL) of the World Health Organization (WHO).

**Results:** Twenty-one relevant articles were included in this review. The prevalence of FNS among the different populations was 5.29% (175 patients out of 3306 patients), 58.3% (95/163) were adults and 41.7% (68/163) were pediatrics. Reprogramming the fitting parameters was the most commonly used technique to control the FNS with 166 managed patients in 20 studies. The different reprogramming techniques resolved the FNS in 85.5% of the patients (142/166). The second management approach was the surgical intervention, either by reimplantation or explanation. It was reported in seven studies for 23 patients, 52.17% of them had failed reprogramming. The onset after CI activation, grade, the number of electrodes associated with FNS, cause of deafness, co-anomalies, and duration of hearing loss were reported.

**Conclusion:** There are many advances in managing and controlling FNS post CI starting with readjusting the fitting parameters and ending with surgical intervention. However, further research is still needed for additional validation of the efficacy of each specific approach and its influence on the patients' performance. CI recipients with FNS still can get many benefits from their devices and FNS problems could be resolved by different methods.

**Primary Author/Presenter:** Asma Alahmadi

**Author Block:** Asma Alahmadi, MD1, Yassin Abdelsamad, PhD2, Medhat Yousef, MD3, Salman F. Alhabib, MD1, Afrah Alshalan, MD1, Nezar Hamed, MD1, Farid Alzhrani, MD1;1Otology, KSU, Riyadh, Saudi Arabia, 2Res. Dept., MED-EL GmbH, Riyadh, Saudi Arabia, 3Audiology Unit, ENT Department, Menoufia University, Menoufia, Egypt, KSU, Riyadh, Saudi Arabia.

**Learner Objectives:**

- To report the different available management strategies for controlling the FNS after CI
- To provide comprehensive evidence, from relevant studies in the literature, regarding the risk factors and the reported management options
Introduction: Hearing performance with cochlear implants (CI) may be influenced by numerous factors which have to be taken into account in the counselling of candidates, surgical planning and subsequently in the postoperative rehabilitation. Patients with syndromic deafness often represent more challenging cases with variable outcomes. Our goal was to compare functional hearing outcomes in CI recipients with genetically confirmed syndromic hearing loss (HL).

Methods: Subjects were selected from our CI database containing ~550 CI recipients implanted at our center. Only those subjects who were diagnosed with syndromic HL based on molecular-genetic testing and had at least one-year experience with CI were included in the study. The hearing performance with CI was evaluated using free-field tone audiometry (FFTA), Slovak speech audiometry (SSA) in quiet and noise and CAP (0-7).

Results: The best outcomes were achieved in the patient group with Pendred syndrome (mean FFTA threshold with CI = 28.5±5.9 dB; SSA in noise = 70±12.6%, CAP = 6.2±0.7). Subjects with mitochondrial disease (MIDD/MELAS syndrome) showed slightly poorer but still very satisfactory results (mean FFTA threshold with CI = 34.4±5.8 dB; SSA in noise = 56±18%, CAP = 6.2±0.8). The poorest outcomes were found in two subjects with CHARGE syndrome (mean FFTA threshold with CI = 93.1±27 dB; SSA in noise = 0%, CAP = 0.5).

Conclusion: The vast majority of syndromic HL patients have great benefit from CI. The only exception were subjects with CHARGE syndrome who showed minimal to no measurable benefit from rehabilitation with CI. Presence and type of inner ear malformations had no substantial impact on the audiological outcomes in our series. However, this study is limited by relatively low numbers of patients suffering from different types of syndromic HL. Supported by research grants APVV-20-0236 and VEGA 1/0572/21.

Primary Author/Presenter: Lukas Varga

Author Block: Lukas Varga, M.D., M.Sc., PhD.1, Diana Ugorova, M.D.1, Zuzana Kabatova, M.D., PhD.1, Silvia Borecka, M.Sc., PhD.2, Marek Sklenar, M.Sc.2, Simkova Ludovika, PaeDr.3, Daniela Gasperikova, M.Sc., DSc.2, Milan Profant, M.D., PhD.1;1Department of Otorhinolaryngology - Head and Neck Surgery, Comenius Univ., Bratislava, Slovakia, 2Diabgene, Biomedical Research Center, Slovak Academy of Sci., Bratislava, Slovakia, 3Department of Speech Therapy, Univ. Hosp. Bratislava, Bratislava, Slovakia.

Learner Objectives:

At the end of the session, participants will be able to distinguish the most common syndromic hearing loss types.

At the end of the session, participants will be able to understand the differences in functional outcomes after cochlear implantation in different hereditary syndromes.
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: Surgery/Medical
Poster Exhibit Number: 60 Student Poster Competition?

Abstract Number: 92
Poster/Abstract Title: 1000 Implants In A Government Program In India- How Good Or Bad

Abstract Content:

Introduction: Over the last few years, cochlear implantation has become the most important treatment modality for children with severe to profound sensory neural hearing loss. Cochlear implantation is a safe and reliable treatment. Variables affecting the outcome of the implant are the duration of disease, etiology of disease, age at onset of deafness, pre-implant hearing aid use, communication mode, age at implantation, type of speech processor, duration of implant usage, family support and financial status, the expertise provided, facilities for rehabilitation. Specifically, pre-implant hearing aid use and the age of implantation are crucial to reducing the effects of deafness on the developing auditory system and capturing the remarkable plasticity of early development. Language development after cochlear implantation requires therapy emphasizing hearing and oral communication, education, and other support which can be influenced by known social determinants of health; specifically, outcomes in children decline with reductions in socioeconomic status and levels of parental education.

Methods: This retrospective study was done between 2016 to 2022 by taking into account various scoring systems like category of auditory performance (CAP), Speech intelligibility rating (SIR) and Glasgow children benefit inventory (GCBI). 1000 children with bilateral severe to profound sensory-neural hearing loss, hearing aid trial for a minimum of 3 months, normal psychological assessment, and normal cochlea on radiology were included in our study. The results were analyzed using the above scoring system to assess the performance level and quality of life of each implanted child taking into consideration practical issues in the Indian setup. The subjects were followed up for a maximum period of 5 years after implantation. Results: 90% of total children implanted showed significantly improved hearing, 80% with significant speech benefit, and 90% with improved quality of life. Outcomes in terms of quality of life, auditory perception, and rehabilitation were very good.

Conclusion: Considerable improvement in hearing, speech, and overall quality of life in almost 80% of children. Early age of implantation showed better hearing, better speech, and better quality of life. A government program has a lot of challenges that have to be considered while evaluating the results.

Primary Author/Presenter: Rohit Mehrotra

Author Block: Rohit Mehrotra, MS ENT MEHROTRA ENT HOSPITAL, KANPUR, India.

Learner Objectives:

Discuss the benefits of cochlear implantation program in Indian scenario
Abstract Content:

Introduction: Congenital cytomegalovirus (cCMV) infection is a leading non-genetic cause of sensorineural hearing loss (SNHL) in children. Patients are often asymptomatic at birth but some develop symptoms later in life, including SNHL. In severe to profound SNHL, cochlear implantation (CI) is the treatment of choice. The aim of this study was to identify patients with cCMV and SNHL and evaluate audiological outcomes after CI.

Methods: We retrospectively reviewed anamnestic data of ~455 patients with CI for positive serology or PCR DNA cCMV infection between 1/2000 and 9/2022. We also launched a pilot screening of cCMV infection by PCR from saliva in infants born between 11/2019 and 9/2022 in our hospital. Infants were subsequently tested for hearing loss by otoacoustic emissions and auditory brainstem response at regular intervals. We evaluated available preoperative audiological results from free field tone audiometry and auditory steady-state response and postoperative results 1 and 3 years after CI from free field tone audiometry, Slovak speech tests, monosyllabic word tests and categories of auditory performance (CAP).

Results: We identified 10 implanted children (1.8%) who deafened due to cCMV infection. Their symptomatology ranged from anemia and microcephaly to spas tic quadriparesis, cerebral palsy and epilepsy. The average hearing threshold before CI was 105 dB. Hearing loss was in all children bilateral, 12 ears were profoundly deaf, 8 ears had severe SNHL and in 5 ears SNHL was progressive. Five children received bilateral and five unilateral CI. The average hearing threshold after 1 year after CI was 40 dB (ranged between 25 and 65 dB). After 3 years the average hearing threshold was 35 dB (ranged between 25 and 45 dB). Slovak speech test was performed in 4 children three years after CI with average maximum discrimination 65%. The CAP varied between 1 and 6 (average CAP=4). Out of 5674 infants screened for cCMV in our pilot study, 11 (0.19%) were confirmed to be positive. All passed the universal newborn hearing screening.

Conclusion: Patients with cCMV clearly benefit from CI. Due to the neurological deficits in some patients, hearing rehabilitation after CI may take longer time and therefore should be more intensive. Screening for congenital CMV is vital in order to identify children with the risk of developing hearing loss in time.

Primary Author/Presenter: Diana Ugorova

Author Block: Diana Ugorova, MD1, Zuzana Volmutova, MD2, Zuzana Polakovicova, MD3, Irena Dobisova, MD3, Darina Chovancova, MD3, Zuzana Kabatova, MD1, Milan Profant, MD1, Lukas Varga, MD1; 1Department of Otorhinolaryngology-Head and Neck Surgery, Faculty of Med. and Univ. Hosp., Comenius Univ., Bratislava, Slovakia, 2Department of Phoniatry, Univ. Hosp. Bratislava, Bratislava, Slovakia, 3Department of Neonatology of M. Rusnak, Slovak Med. Univ. and Univ. Hosp., Bratislava, Slovakia.

Learner Objectives:

Identify patients with congenital cytomegalovirus with hearing loss.

Define functional audiological results after cochlear implantation.
Abstract Content:

Introduction: Cochlear implantation (CI) has become standard of care for individuals with hearing loss who no longer benefit from traditional amplification. Additionally, as life expectancy continues to rise, the number of individuals who can benefit from a CI will further increase. According to Lin et al. (2011), nearly two-thirds of adults in the United States who are aged 70 and older experience hearing loss. With this growing patient population and the likelihood that many of these individuals either are or will become CI candidates, it is vital that we continue to expand our knowledge base on this rapidly growing patient population. The purpose of this study is to compare CI outcomes and device wear time between two groups of older adults to determine if the “younger” older adults perform better on speech perception tasks due to increased wear time.

Methods: 62 patients, ranging in age from 75-94, were identified for this study through retrospective chart review. Patients were divided into two groups: Group A) “younger” older adults (n = 31, age range: 75-84) and Group B) older adults (n = 31, age range: 85-94). Of the 31 patients in Group A, 21 had both post-operative AzBio sentence testing in quiet and datalogging information available for analysis. Of the 31 patients in Group B, 10 had both post-operative AzBio sentence testing in quiet and datalogging information. Datalogging was obtained through the patient’s programming file in the CI software. Independent samples t-test and Pearson correlation were used for statistical analysis.

Results: Average post-operative AzBio sentence testing in quiet scores were 53% (SD: 26.6) for Group A and 56% (SD: 28.2) for Group B. Average wear time was 9.5 hours/day (SD: 3.6) for Group A and 10.25 hours/day (SD: 4.1) for Group B. There was no significant difference in post-operative speech scores between Group A and Group B (t(29) = -.318, p=.753) nor was there a significant difference in wear time between the two groups (t(29) = -.524, p=.604). There was however, a highly significant correlation between post-operative AzBio sentence testing and datalogging for both groups: r=.80, p<.003 and r=.49, p=.01 for Group A and B, respectively.

Conclusion: Initial findings do not suggest “younger” older adults (age 75-84) perform better on speech perception tasks due to increased wear time than older adults (age 85-94). In fact, no difference was observed for post-operative speech scores or device wear time between the two groups. Results do suggest a relationship between better speech perception scores and increased wear time, which is consistent with previous CI research. Further research with a larger number of subjects is needed, although preliminary findings suggest age should not be a barrier to CI.

Primary Author/Presenter: Meghan Hiss

Author Block: Meghan Hiss, AuD, Jeffrey Skidmore, Ph.D., Vivian Kaul, M.D., Oliver Adunka, M.D.; The Ohio State Univ. Wexner Med. Ctr., Columbus, OH.

Learner Objectives:

Identify outcomes in older adult cochlear implant recipients
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: Surgery/Medical
Poster Exhibit Number: 63

Abstract Number: 108
Poster/Abstract Title: Automatic Electrode Scalar Location Assessment after Cochlear Implantation using a Novel Imaging Software

Abstract Content:
Introduction: As of today, imaging to plan and assess cochlear implant electrode insertion is not part of the clinical routine. Due to the low resolution and contrast of computed tomography (CT) and the artifacts of the electrode array, the intracochlear structures are not visible and the location of the electrode array cannot be accurately determined. Further, trauma assessment based on clinical-CT images requires a uniform image-based trauma scaling. Goal of this study was to evaluate the accuracy of the imaging software to detect electrode scalar location, and to introduce a newly developed 3-step scalar location grading system.

Methods: Six cadaveric temporal bones were implanted with Advanced Bionics SlimJ and Mid-Scala electrode arrays. Clinical cone beam CT scans were taken pre- and postoperatively. In addition micro-CTs were taken post-operatively. The software rating was compared to the rating of two experienced otosurgeons and the micro-CT images. A newly introduced 3-step electrode scalar location grading (0 = electrode in scala tympani, 1 = interaction of electrode with basilar membrane / osseous spiral lamina, 2 = translocation of electrode into scala vestibuli) was introduced for the assessment.

Results: The software showed a high sensitivity of 100% and a specificity of 98.7% for rating the electrode location. There was no statistical difference between the trauma evaluation methods (p>0.001) and the correlation between trauma grading methods was strong (kappa > 0.890).

Conclusion: The software gives a fast and reliable method of evaluating the electrode scalar location for cone beam CT scans, and is, in addition to research, also suitable for clinical use. The introduced electrode location grading scale was adapted for assessing clinical CT images.

Primary Author/Presenter: Anil Patnala

Author Block: Stephan Geiger, M.Sc.1, Matti Pekka Iso-Mustajärvi, Ph.D.2, Tim Nauwelaers, M.Sc.1, Ersin Avci, Ph.D.1, Tuomo S Silvast, Ph.D.3, Aarno Dietz, Adjunct Professor2, Anil Patnala, MS4;1Advanced Bionics GmbH ERC, Hannover, Germany, 2Department of Otorhinolaryngology, Koupio Univ. Hosp., Kuopio, Finland, 3Faculty of science and forestry, SIB Labs, Univ. of Eastern Finland, Kuopio, Finland, 4Advanced Bionics, Valencia, CA.

Learner Objectives:
At the end of the session, participants will have a deeper understanding how imaging can help to get reliable and fast results of the surgical outcome from postoperative CT images.
Healthy Aging In Elderly Cochlear Implant Recipients: A Multinational Observational Study

Introduction: Hearing loss greatly affects quality of life in the elderly population and may interact negatively with physical, cognitive, and psychosocial conditions. The aim of the study was to demonstrate the effects of cochlear implantation in senior adults to inform healthcare policy makers and referring professionals of the benefits of cochlear implantation to health-related quality of life.

Methods: Data was collected via an observational registry on adults who were > 60 years at first unilateral cochlear implant with bilateral hearing loss. Criteria for the implanted ear was set according to individual country guidelines and hearing loss in the contralateral ear was moderately-severe to profound. Quality of life was assessed with the Health Utilities Mark III. Hearing and communication skills, cognition, social and emotional loneliness, depression, and risk of falls were assessed with a range of screening measures.

Results: Between baseline and 18 months post implant Health utility improved clinically and statistically significantly by 0.13 points (p<0.001). There were significant changes in the speech and hearing attribute scales. The Speech Spatial Qualities scale improved by 2 points and Categories on Auditory Perception scales improved from level 5 to level 7, both changes were statistically and clinically significantly. In the Hearing Handicap Inventory in the Elderly Screening test, mean and median scores moved the group from significant handicap to mild to moderate hearing handicap by 18 months post implant (p=0.03). There was a significant improvement in the independent daily living scale (p<0.01), with changes in the ability to use the telephone improving the overall score. There was no increased risk of falls and no change on the loneliness scale. Cognition and depression measures also did not change over the study period, however there was minimal cognitive delay and depression in the study group at baseline.

Conclusion: Our findings indicate that there was a significant and meaningful improvement in hearing and communication as well as quality of life. Minimal impact was observed on cognition and depression scales. An encouraging significant shift to a sense of greater independence was reported. The current study provides crucial evidence regarding health improvement in senior unilateral CI recipients. However, to show cognitive benefits, a longer period of follow-up is possibly needed.

Primary Author/Presenter: Sara Ghiselli

Author Block: Domenico Cuda, MD1, Sara Ghiselli, MD, PhD1, Raquel Manrique Huarte, MD2, Mathieu Marx, Professor3, Joël Belmin, MD4, Ángel Ramos-Macias, Professor5, Riyad Khnifes, MD6, Ohad Hilly, MD7;1ENT, AUSL Piacenza, Piacenza, Italy, 2Clinica Universitaria de Navarra, Pamplona, Spain, 3Hôpital Purpan, Toulouse, France, 4Université Pierre and Marie Curie and Hôpital Charles Foix, Paris, France, 5Complejo Hospitalario Universitario Insular Materno Infantil,, Las Palmas de Gran Canaria, Spain, 6Bnai Zion Med. Ctr., Haifa, Israel, 7Rabin Med. Ctr. (Beilinson), Petah Tikva, Israel.

Learner Objectives:
The aim of the study was to demonstrate the effects of cochlear implantation in senior adults to inform healthcare policy makers and referring professionals of the benefits of cochlear implantation to health-related quality of life.
**Abstract Content:**

Introduction: 466 million people worldwide (34 million of which are children), suffer from disabling hearing loss (WHO statement 2018). While the majority of patients with moderate to severe hearing loss can be supplied with conventional hearing aids, some patients may benefit more from implantable hearing devices such as the active transcutaneous bone conduction implant presented here.

Methods: Our objective was to report the one-year audiological- and patient satisfaction outcomes with the second generation Bonebridge (BCI 602) and compare it to our long-term results of the first generation Bonebridge (BCI 601). A retrospective chart review of 26 patients who underwent BCI 602 implantation for the treatment of SSD or M/CHL compared to 57 BCI 601 users was performed.

Results: Twenty-three adult subjects (mean age 35.2±17.0) and three children aged five years or younger (mean age 3.3±1.2) were implanted with the BCI602. The BCI601 cohort comprised of 49 adults (mean age 47.0) and eight pediatric patients (mean age 11.0). The surgery time for the BCI602 in the adult population ranged from 22 to 50 minutes (mean 34.9±8.5) and in the paediatric population (≤5) the mean surgery time was 27±11.5 minutes (18-23 minutes). The mean surgery time for the BCI601 was 55.0±23.0. No surgical nor post-surgical complications occurred in the BCI602 cohort. The mean percentage of speech recognition in quiet for the BCI602 group at 12 months post-surgery significantly improved to 86.67±7.53 (p<.0001) and was 83.46% for the BCI601. The mean speech reception threshold in quiet (SRT) improved significantly at the 12 months follow-up (BCI 602: from 54.76±10.04 to 38.00±9.89, p=.0222)(BCI601: from 65.56 to 41.11, p<0.001). The BCI602 subjects reported high satisfaction with the device accompanied with a mean wearing time of 9.5 hours per day (range 4-17 hours/day). For the BCI601 eleven patients reported at the 3-month interval a mean wearing time of 11.44 hours per day (range 9-15 hours/day).

Conclusion: The one-year results of the new BCI 602 showed significantly improved audiological performance (WRS, SNR), accompanied with high patient satisfaction and improved quality of life. These satisfying results are comparable to the reported 10 years of experience with the BCI601. The reduced size of the BC-FMT makes prior surgical planning redundant and reduced surgical time drastically. Based on these results; the new device BCI 602 can be highly recommended for the given indications and especially for difficult anatomical and surgical cases and a re-evaluation of the given indication for children 5 years or older is highly recommended.

**Primary Author/Presenter:** Georg Sprinzl

**Author Block:** Georg M. Sprinzl, Prof. Dr.1, Philipp Schoerg, BsC.2, Astrid Magele, PD Dr.2;1ENT, Univ. clinic St.Poelten, KL Privat university, St. Poelten, Austria, 2ENT, Univ. clinic St.Poelten, KL Private Univ., St. Poelten, Austria.

**Learner Objectives:**

To learn more about Transcutaneous aktive middle ear implants
Abstract Content:
Introduction: The background is to evaluate long-term stability and residual hearing preservation after cochlear implantation. Methods: Long- and short-term hearing preservation (HP) of 18 subjects (21 ears) was evaluated. Short-term was defined as follow-ups less than 12 months after surgery versus long-term outcomes longer than 12 months post-surgery. The Skarzynski method to calculate Hearing Results: Subjects were implanted with either a MED-EL Concerto or MED-EL Synchrony implant with a Flex 24 (n=14), a Flex 20 electrode array (n=2) or a Flex 26 (n=1) (MED-EL GmbH, Innsbruck, Austria). The Flex 26 is a new inclusion in the Flex-Series and allows an angular insertion depth of approx. 520° with an active stimulation range of 20.9 mm. One subject was implanted with a Cochlear Nucleus CI522 (Cochlear Limited, Australia). Mean period of observation in the short-term group was 4±3.0 months (range 0-7). In the long-term group the mean follow-up was 28.4±15.0 months (range 12-58). Full insertion was possible in all 20 implanted subjects. In the short-term group, complete HP was achieved in 50%, partial HP in 33.3% and minimal HP in 8.3% of the investigated subjects. One subject lost hearing completely. In the long-term group complete HP was achieved in 50%, partial HP was observed in 40% and minimal HP in 10% of the ears. No subject lost hearing completely. Subjects using EAS showed better higher word recognition scores after surgery (mean at 65dB 55.3±18.4; mean at 80dB 68.1±12.2), than subjects using electric stimulation only (mean at 65dB 38.3±18.1; mean at 80dB 60.0±16.4) with non-functional low frequency hearing. Conclusion: The study confirms that hearing can be preserved to a large extend. Subjects with post-operative functional low frequency hearing showed greater benefit in word speech tests. Furthermore, the outcomes show, that implantation is a safe, effective and most importantly a stable treatment option (longest follow-up with 58 months).

Primary Author/Presenter: Georg Sprinzl

Author Block: Georg M. Sprinzl, Univ.Prof. Dr.1, Philipp Schörg, BsC.2, Astrid Magele, PD Dr.2;1Univ. clinic St.Poelten, KL Private Univ., Austria, St. Poelten, Austria, 2ENT, Univ. clinic St.Poelten, KL Private Univ., Austria, St. Poelten, Austria.

Learner Objectives:

- to learn more about hearing preservation in CI
**Title:** Cochlear Implant Extrusion Due To Internal Magnet Allergy

**Abstract Content:**

Introduction: The most common reasons for cochlear implant extrusion are poor surgical technique, flap necrosis and infections. However, some cases of device extrusion reported in the literature seem to be delayed in onset and associated with negative wound culture results, which challenges the established etiologies and suggests a possible alternative causality.

Methods: We describe a rare case of cochlear implant extrusion due to an allergy to the internal magnetic component.

Results: We report a case of a child with progressive bilateral sensorineural hearing loss due to an enlarged vestibular aqueduct. Diagnosis of hearing loss was made at 38 months of life. Due to a progressive auditory worsening and poor right hearing aid outcomes, at the age of 17 years he underwent an uneventful right cochlear implantation. The patient did well until 3 months postimplantation, when skin ulceration and granulation tissue appears over the receiver-stimulator. After initial recovery the skin dehisced again with serous discharge. An allergic reaction was suspected and patch testing was performed showing an allergy to the internal magnetic component of the cochlear implant. The implant was removed and a probe was inserted into the cochlea to avoid ossification. Granulation tissue was find near the receiver-stimulator. Intraoperative cultures were negative. The patient healed without difficulties and 10 months later a custom-made cochlear implant was reimplanted. The patient had no further problems.

Conclusion: In literature few cases about cochlear implant extrusion as a result of allergic reaction are reported. In all these case, the patients developed an allergic reaction to the silicone components of the cochlear implants. To the best of our knowledge, no cases of allergic reaction to the magnetic components of the cochlear implants have been reported until now.

**Primary Author/Presenter:** Margherita Bettini

**Author Block:** Margherita Bettini, MD, Valeria Polizzi, MD, Pasquale Brizzi, audiologist, Giovanni Bianchin, MD; Audiology and Ear Surgery Unit, Azienda USL-IRCCS di Reggio Emilia, Reggio Emilia, Italy.

**Learner Objectives:**

Describe the management of a particular case of cochlear implant internal magnet allergy
Influence of different imaging modalities on the functionality of an otological planning software

Introduction: To enable a personalized cochlear implantation individually adapted to the anatomy of the patient, measurements of the cochlear duct length (CDL) and the respective position of the electrode contacts (ECP) are meanwhile commonly performed. Major advances have been made in recent years regarding the imaging of the cochlea. In addition to the conventional and widely used multi-slice computer tomography (MSCT) flat panel volume CT (fpVCT) and particularly its secondary reconstruction (fpVCT<sub>SECO</sub>) were established. Furthermore, photon counting CT (PC-CT) has been introduced to the clinic and, as a non-radiation alternative, magnetic resonance imaging (MRI) is widely used. OTOPLAN® is a clinical-otologic planning software, that enables examination of different details of the middle and the inner ear. The aim of this study was to evaluate the influence of different imaging modalities on the functionality of the otological software, especially with regard to CDL and ECP measurements.

Methods: CDL and ECP measurements were performed in the otologic planning software OTOPLAN® using MSCT (600µm), fpVCT (460µm), fpVCT<sub>SECO</sub> (99µm), PC-CT (200 µm) and CISS-Sequence of cMRI (460 µm).

Results: The use of OTOPLAN® was very satisfactory due to the user-friendly interface and the integrated analysis tools of the cochlea. CDL and ECP measurements with fpVCT<sub>SECO</sub> and PC-CT were the most precise of the imaging methods used, had the lowest deviations as well as the best inter- and intra-rater variability. CDL measurements increased significantly with low-resolution imaging.

Conclusion: The implementation of higher-resolution imaging is essential for a profound application of the OTOPLAN® software. By this it can be used reliably and has a great potential to be an excellent tool in clinical practice. Furthermore, the pursuit of an individual and anatomically adapted CI implantation is further promoted.

Primary Author/Presenter: Franz-Tassilo Müller-Graff

Author Block: Franz-Tassilo Müller-Graff, Dr. med.1, Johannes Voelker, Dr. med.1, Anja Kurz, PD Dr.1, Rudolf Hagen, Prof. Dr. med. Dr. h. c.1, Tilmann Neun, Dr. med.2, Kristen Rak, Prof. Dr. med.1;1Department of Oto-Rhino-Laryngology, Plastic, Aesthetic and Reconstructive Head and Neck Surgery, Univ. of Wuerzburg, Wuerzburg, Germany, 2Department of Diagnostic and Interventional Neuroradiology, Univ. of Wuerzburg, Wuerzburg, Germany.

Learner Objectives:

Describe, which imaging modalities are prone for a sufficient measurements of cochlea parameters within an otological planning software
Introduction: In cases of NF2 in which the cochlear nerve is compromised the use of an ABI has proven to be an attractive treatment option. The ABI system is designed to restore some hearing sensation achieved through electrical stimulation of the cochlear nucleus complex in the brainstem. Studies have proven the effects of binaural stimulation in hearing aids and cochlear implantation patients. However, less is known about the use of bilateral ABI outcomes. The aim of this case was to evaluate the audiological outcomes of an adult neurofibromatosis type 2 (NF2) patient with bilateral auditory brainstem implants (ABI). Speech discrimination and sound field testing were assessed to measure long-term outcomes and benefits of ABI. A 34-year-old male with NF2 received initial auditory brainstem implantation of the right side in 2011 at an outside facility that was used for 10 years with significant benefit. Second implantation on the left was performed in August 2022 at our institution concurrently with vestibular schwannoma resection. Pre-operative audiogram results revealed no response at 110 dBHL on the right and severe to profound sensorineural hearing loss on the left with 0% speech discrimination bilaterally.

Methods: In total, 14 electrodes produced comfortable auditory only sensations. Impedances were run following psychophysical measurements and were acceptable. After one month of the left ABI being activated the right ABI was activated and reprogrammed as well. Aided assessment was completed prior to reprogramming and at each follow-up while patient wore a processor on each side individually and bilaterally. Aided sound field thresholds were obtained at 20-40 dBHL for 250-6000 Hz. Aided sound field testing was completed using HINT sentences. Performance was assessed for audition, speech, and language.

Results: The patient was assessed using sound field audiometry and HINT sentences with each ABI individually and bilaterally. Aided sound field thresholds were obtained at 20-40 dBHL for 250-6000 Hz. Speech perception was assessed using recorded and monitored live voice materials presented at 50 dBHL with and without visual cues. Following activation, unilateral ABI understanding increased from 14% to 63% (right) and 40% to 84% (left) at 6 months in audio-only condition and 93% to 96% (right) and 92% to 100% (left) in audio-visual condition. Bilaterally, audio-only open-set speech understanding increased from 71% to 92% at 6 months and 92-100% in audio-visual condition.

Conclusion: Patient performance with bilateral ABIs as well as individual ABIs (right and left) showed significant benefits in understanding speech and sentences with an improvement of 0% at pre-operative testing to 92% bilaterally in speech discrimination. Performance exceeds expectations for environmental sound awareness and early speech perception and is a unique example of highly successful bilateral ABI audiological outcomes.

Primary Author/Presenter: Madeline Gibson

Author Block: Madeline E. Gibson, BA1, Olivia La Monte, BS1, Alicia A. Williams, AuD2, Omid Moshtaghi, MD1, Elina Kari, MD1, Rick A. Friedman, MD, PhD1, Marc Schwartz, MD, PhD1;1Head and Neck Surgery, UCSD, San Diego, CA, 2Audiology, UCSD, San Diego, CA.

Learner Objectives:
Describe communication advantages of bilateral ABI implantation.

Compare audiological outcomes for a patient with bilateral ABI.
Introduction: Cochlear implants have become a standard treatment for severe to profound hearing loss across the world. Cochlear implant candidacy has evolved as recent improvements in electrode design have resulted in the ability to preserve natural hearing during cochlear implantation. Numerous studies reveal benefits of hearing preservation including improvement in hearing speech in noise and music appreciation. The Cochlear Nucleus Slim Modiolar Electrode (CI632 and CI532) is a full length, perimodiolar electrode. Since 2016, over 350 cochlear implants with slim modiolar electrodes have been implanted in our cochlear implant program. Standard FDA approved indications were utilized. Clinically, we have seen many cases of preserved hearing in which we are able to utilize an acoustic hearing component in addition to the speech processor to improve patient performance post-operatively.

Methods: A retrospective chart review of patients implanted with slim modiolar electrodes (CI632 and CI532) was completed. A total of 359 ears were reviewed. Preoperative and postoperative audiometric and speech perception results were compiled into a database for review.

Results: Hearing was consistently preserved in patients with slim modiolar electrodes. In many cases, acoustic stimulation in combination with electric stimulation was possible. Patients with residual acoustic hearing had significant improvements in speech perception following cochlear implantation.

Conclusion: Hearing preservation with a full length cochlear implant electrode is possible on a consistent basis. Combined electric and acoustic hearing results in improved satisfaction and speech understanding. For those without hearing preservation, the advantages of a full length CI electrode are maintained.

Primary Author/Presenter: Robert Cullen


Learner Objectives:
Participants will describe the feasibility of hearing preservation with a full length electrode.
Abstract Content:

Introduction: In 2020, the FDA instituted a voluntary field corrective action (VFCA) on specific cochlear implant models at risk of device failure secondary to fluid ingress into the electrode. Our institution previously presented our single-institution experience with the devices of interest. Herein, we report our outcomes for those patients that were reimplanted after their initial device failure.

Methods: A retrospective chart review of the aforementioned patient population was performed. Hearing and speech perception testing conducted before and after reimplantation was evaluated.

Results: 90 cochlear implants falling under the FDA voluntary field corrective action were placed in years 2016-2020. The overall failure rate for these implants was 20.0% (18/90), and 15/18 (83.3%) failing devices experienced a hard failure. 13/15 (87%) patients with a hard failure underwent explant and reimplantation, with one patient deferring reimplantation due to a functional contralateral device and one patient awaiting reimplantation due to insurance issues. In all patients, reimplantation surgery was uneventful, and a full insertion was achieved. There were no postoperative complications. Average follow up from reimplantation was 9.2 months (range 0.7-24.5 months). 12/13 (92%) reimplanted patients selected a new device from the same company as their original device. 9/13 (69%) have received some form of audiometric testing following reimplantation. 8/9 received Ling 6 testing. Ling thresholds were statistically lower following reimplantation compared to pre-explantation (28.89dB vs 22.08dB, p=0.001). 3/9 underwent Consonant-Nucleus-Consonant (CNC) speech perception testing before and after surgery. In all three cases (100%) the ipsilateral CNC score following revision surgery met or exceeded that of the best ipsilateral CNC score achieved following initial implantation. Average device use of the new devices is 11.6 hours/day (range 1.4-16 hours). All patients or their guardians reported satisfaction following reimplantation.

Conclusion: Preliminary data suggest good outcomes following reimplantation for patients with explanted devices falling under the 2020 VFCA.

Primary Author/Presenter: Sunder Gidumal

Author Block: Sunder Gidumal, MD, Zachary Schwam, MD, Lisa Goldin, PhD, Kevin Wong, MD, Enrique Perez, MD, George Wanna, MD, Maura Cosetti, MD; Otolaryngology, Mount Sinai, New York, NY.

Learner Objectives:

Describe surgical, postoperative, and audiometric outcomes of patients with devices falling under the 2020 Food and Drug Administration (FDA) voluntary field corrective action who had their cochlear implant explanted and were reimplanted with another devi
Introduction: Intracochlear electrocochleography (ECochG) has emerged as a research area to investigate hearing preservation in cochlear implant (CI) users. The objective of the study was to describe intraoperative monitoring using ECochG and to compare the objective audiometry and behavioral audiometry in the first 90 postoperative days. Methods: Prospective, longitudinal study of 10 adults with measurable low frequency hearing that were implanted with a slim straight electrode inserted by freehand technique. Preoperative evaluation involved tonal auditory thresholds as well as speech perception tests. During electrode insertion, intraoperative electrocochleography was conducted using active insertion monitoring system. Auditory stimuli were delivered through an insert earphone and consisted of 50 milliseconds tone burst with alternating starting phase and 2 milliseconds rise/fall or single cycle. The ECochG responses were assessed intraoperatively directly from the most apical electrode contact. The amplitude of the real-time ECochG curve was characterized in 4 different moments: (1) increase in amplitude at the beginning of insertion through the round window, (2) maximum amplitude, (3) final amplitude after full insertion and (4) drops or amplitude changes during round window seal with muscle fascia graft. Post-operative evaluation consisted on a longitudinal assessment of auditory thresholds as well as electrocochleography after 7, 14, 21, 30 and 90 days of the surgery. The hearing preservation (S) was calculated based on formula proposed by Skarzynski et al. (2013). Results: Of the total 10 patients, 7 patients showed ECochG responses during insertion. The average insertion time was 130 seconds. Postoperative audiological findings showed progressive improvement in air conduction hearing thresholds over the three months after surgery, possibly secondary to postoperative hemotympanum reduction. Residual hearing was fully or partially preserved in 9 of 10 subjects. Objective ECochG thresholds measured within the first 90 days postoperatively are higher than behavioral thresholds. Conclusion: The use of ECochG measurement intraoperatively and in the early postoperative period of CI surgery allows real-time information of the electrode insertion process and it also provides more detailed assessment of hearing preservation.

Primary Author/Presenter: Natália Shigematsu

Author Block: Natália Q. Shigematsu, MD1, Carla A. U. F. Queiroz, Ph.D2, Nelma E. Z. Amorim, Ph.D2, Ana Claudia Martinho-Carvalho, Ph.D3, Maria S. A. Amaral, MD, Ph.D1, Ana Claudia B. M. Reis, Ph.D2, Miguel A. Hyppolito, MD, Ph.D1, Eduardo T. Massuda, MD, Ph.D1; 1Department of Ophthalmology, Otorhinolaryngology, Head and Neck Surgery, Ribeirão Preto Med. Sch., Univ. of São Paulo, Ribeirão Preto, Brazil, 2Department of Health Sciences, Ribeirão Preto Med. Sch., Univ. of São Paulo, Ribeirão Preto, Brazil, 3Clinical Research Department, Advanced Bionics, Valencia, CA.

Learner Objectives:

To describe intraoperative monitoring using ECochG in adults with measurable low frequency hearing.

To compare the ECochG thresholds and the behavioral audiometry.
Introduction: Pediatric cochlear implants represent a revolutionary surgical intervention, calling to attention the importance of investigating patient perspectives so providers can provide proper counseling. Social media is an up-and-coming informational tool for most patients and often consists of opinions and perspective not always expressed to clinicians. In this study, we investigated Twitter to understand parental attitudes and experiences towards cochlear implant (CI) surgery in children that may not be otherwise apparent through clinical encounters.

Methods: In this qualitative study, the social media platform Twitter was searched for posts (tweets) published between January 1, 2017, and December 31, 2021, using search criterion of cochlear implant with the pediatric identifiers: kid, child, baby, daughter, or son. Modified ground theory approach (M-GTA) was employed to categorize tweets into major thematic domains, which were further analyzed with descriptive statistics.

Results: A total of 1189 total tweets were identified. Tweets were categorized by author type including parents/caregivers, support groups, general public, or medical providers. These categories were further analyzed by twelve thematic categories: indications/pre-operative education (62 tweets, 5.2%), post-operative recovery (8 tweets, 0.7%), negative surgical experience (10 tweets, 0.8%), post-CI experience/testimonials (357 tweets, 30.0%), CI activation reaction (93 tweets, 7.8%), preconceived negative opinions (117 tweets, 9.8%), apprehension about surgery (27 tweets, 2.3%), support/awareness (219 tweets, 18.4%), financial/barriers to access (167 tweets, 14.0%), adjunct language skills (46 tweets, 3.9%), research (36 tweets, 3.0%), other (47 tweets, 4.0%).

Conclusion: Social media provides a platform for parents to divulge attitudes that they may not otherwise express to clinicians. The results of our study highlight that surgical intervention with a CI in children poses many misconceptions and controversies. This emphasizes importance of identifying patient discomforts and perspectives so providers can fill these knowledge gaps to better aid in counseling and shared decision-making.

Primary Author/Presenter: Sudeepti Vedula

Author Block: Sudeepti Vedula, BS1, Aparna Govindan, MD2, George Wanna, MD2, Enrique Perez, MD2, Maura Cosetti, MD2; Otolaryngology - Head and Neck Surgery, Rutgers New Jersey Med. Sch., Newark, NJ, Otolaryngology - Head and Neck Surgery, Icahn Sch. of Med. at Mount Sinai Hosp., New York City, NY.

Learner Objectives:
Identify themes of parental perspectives regarding pediatric CI and classification of public information and opinions
Abstract Content:

Introduction: Hearing loss, as the most undertreated disability in the United States, affects over 2 million people. Since its development, cochlear implantation (CI) technology has led to advancements in hearing loss rehabilitation with ever-expanding indications for placement. The purpose of this study was to evaluate rates and predictors of CI adoption among audiometric CI candidates at an urban safety-net hospital. Methods: A retrospective cohort study comparing adults with post-lingual bilateral sensorineural hearing loss (SNHL) who underwent audiologic evaluation for cochlear implantation at an urban safety-net health system between October 2021 to October 2022 was performed. Demographic, audiological, relevant medical history, and surgical decision-making data were collected from patient records. Descriptive statistical analyses, univariate analyses, and multivariate logistic regression analyses were performed comparing the features of patients who proceed with implantation and those who deferred. Results: In total, 20 (95%) out of the 21 adults evaluated for CI were deemed audiometric candidates, and 15 (71%) proceeded with surgery. Patients who did not proceed with surgery were more likely to have public insurance (100% vs 60.0%; p=0.03), a higher mean age in years (74.6 vs 57.6; p=0.02), worse American Society of Anesthesiologists (ASA) Physical Status Classification System scores (3.2 vs 2.5, p=0.04), and a non-English primary language (33.3% vs 20.0%; p=0.53). However, these results were not statistically significant on multivariate logistic regression analysis. Conclusion: Adults residing in this small urban community cohort had a CI adoption rate of 71% after presenting for in-office cochlear implant evaluation. Larger studies are needed to further elucidate predictors of proceeding with surgery for cochlear implant candidates. This knowledge may help build tailored systems to address the unique barriers to hearing rehabilitation faced by at-risk groups.

Primary Author/Presenter: Arnav Shah


Learner Objectives:

Discuss the factors that influence patients from urban and under-resourced communities to proceed with cochlear implantation
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

**Poster Category:** Surgery/Medical

**Poster Exhibit Number:** 75  
**Student Poster Competition?**

**Abstract Number:** 183

**Poster/Abstract Title:** Case study on post lingual cochlear implantation following an explantation of contralateral ear in auditory-verbal adult male.

**Abstract Content:**

Introduction: Prelingually deafened patients who are implanted in adolescence or adulthood have varying levels of success.

Methods: We report an interesting case of post lingual implantation after two explantations of the contralateral early-implanted ear for implant infections and wound reconstruction with a supraclavicular artery island flap.

Results: A 26 year-old male with a history of bilateral congenital sensorineural hearing loss presents with a right sided cochlear implant infection and wound dehiscence. The patient was initially implanted at 18 months old but was subsequently explanted/re-implanted when he was 8 years old due to an implant infection. Patient recovered well and was subsequently an excellent user of that implant until age 26, when he presented to our clinic with a new infection and exposure of the implant. He had admitted he had been wearing tight fitting hats and had swelling around the magnet area a month prior to presentation. His AzBio tested at 81%. The left ear had never been aided. The patient was treated initially with culture-directed oral antibiotics without improvement, and then taken to the OR for debridement/washout and wound closure. However, due to persistent purulent drainage and wound dehiscence, patient returned to the OR for explantation. Coverage of the skin defect was achieved with a right supraclavicular artery island flap. At the same time, the left ear was implanted to provide auditory input while the right ear was observed for any infection recurrence. Patient was placed on post operative IV antibiotics for 6 weeks. The left ear AzBio was 0% pre surgery, 0% at 1 month, 29% at 4 months and 44% at 6 months. Patient used only the left sided implant for 8 months until reimplantation of the right ear after noting no further infections. Post operatively, the right ear AzBio in Quiet was 52% at 1 month, and 77% at 14 months. Binaural performance on the AzBio was 94% in quiet and 86% at a +10SNR at 22 months post initial explantation of the right ear/implantation of the left ear. No further infections or wound dehiscences were seen at 14 months post reimplantation.

Conclusion: In this collaboration among otology, audiology, and reconstructive surgery, the patient demonstrated benefit with his newly implanted ear after explantation of the early-implanted contralateral ear as well as the capability of covering a temporal skin defect with an island flap. This case also illustrates the potential benefit of implantation of a prelingually ear without prior auditory rehabilitation.

**Primary Author/Presenter:** Lauren Brewster

**Author Block:** Lauren Brewster, BS, Connor Sullivan, AuD, Angela Haskins, MD, Angela Peng, MD; Baylor Coll. of Med., Houston, TX.

**Learner Objectives:**
At the end of the session, participants will be able to consider post lingual implantation with contralateral early implanted ear.
CI2023 Dallas: Cochlear Implants in Children and Adults

At the end of the session, participants will be able to incorporate alternative island flap for coverage of a cochlear implant wound defect.
Abstract Content:

Introduction: Pediatric temporal bone fractures can rarely cause single-sided deafness. Cochlear implantation (CI) has the ability to restore hearing in these patients.

Methods: A retrospective review was performed at a tertiary academic center. Inclusion criteria were the following: patients less than 18 years of age with temporal bone fractures who underwent CI from 2012 - 2022. Patients with significant medical comorbidities were excluded. Descriptive statistical analyses were performed.

Results: Five patients met inclusion criteria for this study. Median age at time of CI was 9.62 (IQR 13) years. The median time from injury to CI was 7 (IQR 47) months. Eighty percent (4/5) of patients had otic capsule involving temporal bone fractures. All patients had profound sensorineural hearing loss with 0% or untestable word recognition scores preoperatively. Two patients (40%) had facial nerve weakness at the time of injury that recovered prior to surgery. Full cochlear implant electrode insertion was achieved in all cases, although one patient (20%) required scala vestibuli insertion due to ossification of the scala tympani. All patients who had a postoperative X-ray (4/4) showed that the electrode was in appropriate position in the cochlea. Postoperative impedance testing was normal in all patients (5/5). At least 60% (3/5) of patients used their cochlear implant after surgery. No devices were explanted, and no postoperative complications were observed.

Conclusion: Cochlear implantation can be performed successfully in pediatric patients who sustain temporal bone fractures resulting in single-sided deafness.

Primary Author/Presenter: Mana Espahbodi

Author Block: Mana Espahbodi, MD, Cody M. Anderson, MD, Evan L. Tooker, MS, Eric E. Babajanian, MD, Neil S. Patel, MD, Richard K. Gurgel, MD, MSCI; Otolaryngology - Head & Neck Surgery, Univ. of Utah, Salt Lake City, UT.

Learner Objectives:

To describe intraoperative findings during cochlear implantation for single-sided deafness after temporal bone fracture.

To describe the postoperative course after cochlear implantation for single-sided deafness after temporal bone fracture.
**CI2023 Dallas: Cochlear Implants in Children and Adults**

**Poster Exhibit Abstract**

**Poster Category:** Surgery/Medical

**Poster Exhibit Number:** 77  
**Student Poster Competition?**

**Abstract Number:** 208

**Poster/Abstract Title:** Is there a difference in the results of cochlear implants in children implanted by supplementary health and in the unified health system?

**Abstract Content:**

Introduction: In Brazil, cochlear implant (CI) is indicated and approved by SUS and supplementary health in cases of sensorineural and profound hearing loss. Methods: Retrospective cross-sectional study in implanted children whose speech processor had datalogging. Access (private or public), etiology, comorbidities were collected, and age at first consultation, age at surgery, and hours of device use, IT-MAIS, MUSS and family involvement were analyzed using the Mann Whitney test at 6 and 24 months after CI. Results: Data were collected from 43 children divided into groups accessed by SUS (N=17) and by supplementary health (SS) (N=26). The most frequent etiology was congenital unknown in both groups. The median age at first consultation as a candidate for CI was 22 and 12 months, and the mean age at surgery was 24 (12-36) months and 12 (9-48) months for the SUS and SS groups, respectively, with significant difference. A greater number of comorbidities was found in the SS group (31%) over 18% of SUS children. The number of hours of device use, as well as the values of IT-MAIS, MUSS and family involvement were higher in the SS group, with no significant differences at 6 and 24 months. Conclusion: Differences found in age at implantation showed no impact on the development of children who received cochlear implants through the public or private system in the sample that includes children with comorbidities.

**Primary Author/Presenter:** Guilherme Biondi Ferreira Bento

**Author Block:** Guilherme Biondi Ferreira Bento, Medical Student1, Maria Valeria Schmidt Goffi Gomez, Doctorate2, Claudia Colalto, speech therapist2, Rubens Vuono de Brito Neto, Full professor2, Ricardo Ferreira Bento, Full professor2; São Leopoldo Mandic, Campinas, Brazil, 2Otorrinolaringologia, Hosp. das clinicas da faculdade de medicina da USP São Paulo, São Paulo, Brazil.

**Learner Objectives:**

At the end of the session, participants will be able to see if there is a difference in the result of cochlear implantation in the private and public system.
CI2023 Dallas: Cochlear Implants in Children and Adults
Poster Exhibit Abstract

Poster Category: Surgery/Medical
Poster Exhibit Number: 78  Student Poster Competition?

Abstract Number: 223
Poster/Abstract Title: Cochlear Implantation in Single sided Deafness and Asymmetric Hearing Loss focusing on Congenital Cytomegalovirus Infection

Abstract Content:

Introduction: In 2019, the US Food and Drug Administration approved cochlear implantation (CI) for single-sided deafness (SSD) and asymmetric hearing loss (AHL) for patients aged five years and older. However, improvement in speech perception, vocabulary development, and vowel/consonant accuracy of SSD/AHL children younger than five years still awaits further accumulation of evidence. Further, there is a paucity of reports addressing the prognostic factor for CI outcome and the better candidacy of CI among pediatric SSD/AHL unrelated to cochlear nerve deficiency. This study was conducted to discern the best candidacy for CI among these subjects.

Methods: We retrospectively reviewed all the pediatric CI recipients with SSD/AHL operated by a single surgeon between October 2016 and January 2022. Data on demographics, preoperative and postoperative audiologic assessment developmental tests to evaluate the child’s cognitive skills, etiology of hearing loss, radiographic studies such as temporal bone computed tomography and magnetic resonance imaging were reviewed.

Results: During the study period, 199 pediatric subjects received CI. Eighteen (9%) candidates were implanted due to SSD/AHL. Two subjects received bilateral sequential CI and 16 received unilateral implantation. The mean age at implantation was 39.6 (standard deviation 24.8, range: 13 - 97) months. Children with SSD/AHL due to congenital cytomegalovirus infection (n= 10) exhibited varied outcome. Children with cognitive deficit, adverse findings from MRI or severely delayed receptive language yielded poor results. Children with normal cognition that show mild receptive/expressive language difficulties appears to benefit from CI in terms of pronunciation and expressive language. Children with normal cognition that show mild receptive/expressive language difficulties that can be obtained through CI against the limitations of the development due to cognitive impairment.

Primary Author/Presenter: Byung Yoon Choi

Author Block: Yehree Kim, MD, PhD, Byung Yoon Choi, M.D., Ph.D; Department of Otorhinolaryngology, Seoul Natl. Univ. Bundang Hosp., Seongnam, Korea, Republic of.

Learner Objectives:

At the end of the session, participants will be able to distinguish better candidacy for CI among children with single-sided deafness and asymmetric hearing loss.
Poster Category: Surgery/Medical

Poster Exhibit Number: 79

Abstract Number: 227

Poster/Abstract Title: The Effect of Surgeon Experience and Insertion speed on intracochlear pressures during In-Vitro Cochlear Implantation

Abstract Content:

Introduction: Preservation of residual hearing is an important goal of modern cochlear implant surgery. Many factors are thought to be significant in the preservation of residual hearing through the reduction in intraoperative trauma to the cochlea. Methods: Participants at a cochlear implantation hearing preservation workshop open to surgeons and audiologists were invited to participate in a challenge to insert a cochlear implant electrode into an In-Vitro model of a cochlea. Intracochlear pressure variation was measured as a surrogate marker for intracochlear trauma against insertion speed, method of insertion, moisturization of the electrode, and participant experience. Results: The study demonstrated that the relative experience of a surgeon and the speed of insertion were significant for maximal intracochlear pressure variation. The more experienced participants likely to demonstrate lower pressure variation, and a slower insertion on average (0.124kPa) produced significantly smaller pressure changes than a fast insertion (0.177kPa). No other variables were deemed significant for maximal pressure variation. Conclusion: Surgeon experience and speed of implant insertions were significant factor in the reduction of intracochlear pressure variation during cochlear implantation simulations.

Primary Author/Presenter: William Crohan

Author Block: William Crohan, MBBS, MSENT, Univ. of Western Australia, Perth, Australia.

Learner Objectives:

At the end of the presentation, participants will know that surgical experience is an important factor for hearing preservation, and the quantitative degree to which this is the case.

At the end of the presentation, participants will know the basic mechanical factors significant for hearing preservation (Speed, force, angle).
Abstract Content:

Introduction: Preservation of residual hearing is an important goal of modern cochlear implant surgery. Many factors are thought to be significant in the preservation of residual hearing through the reduction in intraoperative trauma to the cochlea. We aim to investigate and compare the relative forces of cochlear implantation in robotically assisted and traditional cochlear implantation surgery.

Methods: Using a similar in-vitro model of the Scala Tympani previously reported in the literature for operative factors of Hearing Preservation Cochlear Implantation, ADDIN EN.CITE<br>(1) intra-cochlear pressure rise, variation and time were measured as surrogate markers for trauma to the cochlea during surgery, against different methods of handling the cochlear implant electrode. The model was a plastic mould of the Scala Tympani, with a mechano-optical fibre optic pressure installed at the apex of the Cochlea that measured pressure changes along the fluid column. As a simple form of robotically-assisted surgery, a cochlear implant electrode was mounted onto a basic syringe driver with human guidance. Using a slow insertion, soft surgery technique, this was gently inserted into the plastic model. The measurements using this methodology were contrasted against a traditional, instrument-held soft surgery technique.

Results: The experiment demonstrated a clear disparity between robotically assisted and traditional cochlear implantation. As predicted, robotically assisted surgery led to a significant reduction in the variation in intracochlear pressure. This effect was particularly pronounced during longer insertion times.

Conclusion: Robotically assisted surgery has the potential to greatly reduce the force and trauma transferred to the cochlea during cochlear implantation.

Primary Author/Presenter: William Crohan

Author Block: William Crohan, MBBS, MSENT, Univ. of Western Australia, Perth, Australia.

Learner Objectives:
CI2023 Dallas: Cochlear Implants in Children and Adults

At the end of the presentation, participants will be able to know the quantitative difference between humans and robotic devices with regards to intracochlear pressure variation during cochlear implantation.
Abstract Content:

Introduction: The position between the cochlea implant electrode array and the neural structures is crucial for the audiological outcome in CI surgery. Using the pullback technique, an electrode position closer to the modiolus can be achieved in perimodiolar electrode arrays. An approximation to the modiolus could be demonstrated by improved electrophysiological recordings after finalizing the pullback. Methods: Twenty patients were implanted with Nucleus Slim perimodiolar electrode arrays (Cochlear Pty, Sydney). After complete insertion of the electrode, a controlled pull-back by about 1.5mm was performed. Electrophysiological measurements were performed before and after the pullback. Radiologic images were evaluated postoperative including the intracochlear positioning index, wrapping factor and homogeneity factor. Results: Significant lower threshold neural response telemetry (t-NRT) data were found between electrode 7 and 11 after the pull-back. Impedances remained unchanged during this procedure. Intracochlear partition index is significant lower between electrode 7 and 11. Conclusion: The hearing benefit with cochlear implant as rehab strategy has been successful documented over the last few decades. In this series, a pullback of the CI electrode after full insertion showed an improved electrophysiological pattern of NRT data and preferred intracochlear position. It remains a matter for further studies to correlate those data with long-term audiological outcome data.

Primary Author/Presenter: Gina Lauer

Author Block: Gina Lauer, MD, Arne Ernst, MD, Philipp Mittmann, MD; Unfallkrankenhaus Berlin, Berlin, Germany.

Learner Objectives:

use the pullback to optimize the neural implant interface.
Abstract Content:

Introduction: Waardenburg syndrome (WS) is a genetic disorder that can cause hearing loss and changes in coloring of the hair, skin and eyes. This syndrome was first described by the Dutch Ophthalmologist Petrus Johannes Waardenburg in 1951. It affects 1 in 40,000 births and accounts for 2 - 5% of all cases of congenital hearing loss. Males and females were affected relatively equally. In most cases, WS is inherited as autosomal dominant manner. However, some cases appear to have an autosomal recessive pattern of inheritance. There are four types of WS which are distinguished by their clinical presentations and genetic cause. Type I and II have very similar features, except for the sign of dystopia canthorum is common in type I, while type II does not. Type III (known as Klein-Waardenburg syndrome) includes anomaly of the arms and hands associated with hearing loss and changes in pigmentation. Type IV (sometimes called Waardenburg-Shah syndrome or Waardenburg-Hirschsprung disease) has signs and symptoms of not only WS but also Hirschsprung disease.

Background: Waardenburg syndrome is a rare genetic disorder characterized by hearing loss in association with pigmentary defects of the skin, hair and eyes. It is caused by the gene mutation involved in the development of melanocyte. There are four types of Waardenburg syndrome which are distinguished by their physical examinations and genetic cause.

Methods: Case report: A five years old, female child attended our hospital because of bilateral profound sensorineural hearing loss detected at 4 months of age. She had blue eyes, dystopia canthorum, white forelock of hair, leukoderma on the forehead and nose, broad nasal root. Her brother and grandmother also had a change in iris pigment and normal hearing. PAX3 mutation was found on genetic testing. She was diagnosed with Waardenburg syndrome type I. Congenital hearing loss was managed by cochlear implant surgery. About medical history, there were not any anomalies noted during pregnancy related to risk factors for congenital hearing loss (such as TORCH infections, etc.). However, we noted that her grandmother and brother also had a change in the iris color, but there were no loss of hearing recorded. Audiological results showed that this baby had bilateral profound hearing loss.

Results: The audiological result was normal with activation of implant post-operatively. Her CAP score was 7 at four years after surgery.

Conclusion: Although Waardenburg syndrome is a rare disorder, it could affect significantly to patient’s development, especially congenital sensorineural hearing loss. Early recognizing of this syndrome and screening of other associated abnormalities will aid doctors in making management strategy to obtain an optimal outcome.

Primary Author/Presenter: Minh Le

Author Block: Minh T. Le, MD, PhD1, Phu D. Nguyen, MD2; 1ORL Department, ENT Hosp., HCMC, Pham Ngoc Thach Univ. of Med., HCMC, Viet Nam, 2 Otology Department, ENT Hosp., HCMC, HCMC, Viet Nam.

Learner Objectives:

At the end of the session, participants will be able to explain the four types of Waardenburg Syndrome (WS) as distinguished by their clinical presentations and genetic cause.
At the end of the session, participants will be able to discuss the benefits of early cochlear implantation in Waardenburg Syndrome (WS) patients with congenital sensorineural hearing loss.
Abstract Content:

Introduction: Maximum power output (MPO) levels of bone conduction hearing systems (BCHS) vary between different models, but are always significantly lower than those of conventional hearing aids, thus potentially limiting speech understanding. In this project we investigated, how MPO influences speech understanding in quiet and in noise in BCHS users.

Methods: 12 adult BAHS users with considerable a bilateral conductive hearing loss and additional sensorineural hearing components between 4 and 45 dB (500-4000 Hz) participated in the study. Speech understanding was measured at 65 dB in quiet and in noise with 4 different MPO level settings, covering the approximate range of MPOs found in currently available BCHS devices.

Results: Speech understanding in quiet and in noise decreased with increasing sensorineural hearing loss. Different MPO levels did not influence speech understanding in quiet significantly. In contrast, speech understanding in noise was better with higher MPOs (average improvement in signal-to-noise ratio +3.2 dB, \( p<.001 \)), but only if the sensorineural hearing loss component was above approximately 35 dB.

Conclusion: At normal conversational levels, higher MPOs have little or no influence on speech understanding in quiet with BCHS. However, they can improve speech understanding in noise for users with additional sensorineural hearing loss.

Primary Author/Presenter: Martin Kompis

Author Block: Martin Kompis, MD PhD, Tom Gawliczek, PhD, Wilhelm Wimmer, PhD, Marco Caversaccio, MD;ENT, Inselspital, Univ. of Bern, Bern, Switzerland.

Learner Objectives:

Compare typical maximum power output (MPO) levels of bone conduction and conventional air conduction hearing aids

Outline the effect of higher maximum power output on speech understanding of users with different bone conduction thresholds.
Abstract Content:

Introduction: We all love our animals and want the best for them. This is a case study about using an Oticon Medical Ponto device to help a deaf cat. Her owner noticed that the cat was not responding to any noises or voice. In addition, the cat exhibited changes in behavior including staying in one place all day, yelling more than usual, becoming aggressive towards the owner and the other cats, and losing weight. In general, the cat did not appear comfortable in her environment in the way she once had. Although not widely available, there have been some attempts to provide hearing aids for dogs and cats. There have been some cats who have received cochlear implants, but only under experimental conditions. The purpose of this study is to document the responses of a cat fit with a softband Ponto device.

Methods: The cat's unaided hearing was tested by observing the responses to various sounds that were created while the cat slept or faced the opposite direction. The Oticon Medical Ponto device was fitted as a collar around the cat's neck using the softband, but was later fitted around the cat's torso with the device resting along the spine to minimize feedback. The device was worn for 16 hours/day for 4 weeks. After four days of use, the device was reprogrammed with increased amplitude to optimize vibrotactile sensation considering the insulation of the cat's fur. With the cat wearing the device and sleeping or facing away from the experimenter, we would create noises at various frequencies and record the cat's responses. The cat's behavior before and after a month of device usage were recorded.

Results: The cat exhibited responses to sounds of various frequencies when wearing the Ponto device that were not exhibited unaided. These responses consisted of waking up from sleep and looking around when sounds were created. After 4 weeks, the following behavioral changes were appreciated: elimination of loud vocalizations and elimination of aggressive behavior, biting, towards both humans and other cats. The cat gained weight throughout the course of the experiment. The perceived energy level of the cat throughout the experiment was grossly unchanged. The cat seemed to enjoy the device and did not appear uncomfortable or annoyed by the device.

Conclusion: The use of the Ponto device for this cat was considered successful. Her behavior and personality were affected positively by using the device.

Primary Author/Presenter: Jolie Fainberg

Author Block: Jolie C. Fainberg, AuD, Emily Glatter, BS; 1Audiology, Atlanta Institute for ENT/Atlanta Children's ENT, Alpharetta, GA, 2Otolaryngology, Atlanta Institute for ENT/Atlanta Children's ENT, Alpharetta, GA.

Learner Objectives:

At the end of this session, participants will be able to describe the changes in behavior after the use of the Ponto device.

At the end of this session, participants will be able to discuss the feasibility of using bone conduction devices on deaf animals.
Abstract Content:

Introduction: Cochlear implantation has become the standard-of-care management strategy for moderate to profound sensorineural hearing loss (SNHL), and over time, the numbers of cochlear implant (CI) users has grown substantially. In 2019, it was estimated that there were 700,000 established CI users. As established CI users become older and CI surgery becomes more commonplace, more situations will arise in which the presence of a CI may require special consideration in medical decision making, even for medical and surgical issues not directly related to hearing. One example of this type of situation can be found in the management of a cochlear implant during magnetic resonance imaging (MRI). Another example is the use of monopolar cautery with an indwelling CI, which is relevant due to the potential risk to the internal device and the cochlea. Herein, we present a patient whose CI processor was damaged following cardioversion for atrial fibrillation to add to the relatively small amount of existing literature dedicated to this clinical scenario.

Methods: An 81-year-old male with a history of progressive bilateral sensorineural hearing loss presented to our clinic for CI evaluation. His otologic history was unremarkable aside from two prior episodes of seemingly sudden hearing loss on the left side. On examination, his ears were normal. No issues arose postoperatively or during his device activation and subsequent programming. Over time, he appeared to receive significant benefit from his device. Specifically, postoperative Consonant-Nucleus-Consonant (CNC) word scores reached 72% around 8 months after activation. Ten months after activation, he presented to an outside facility emergency department in atrial fibrillation. During this hospitalization, he underwent cardioversion. Though this procedure was successful in terms of his arrhythmia, his wife noticed a subsequent worsening of his hearing.

Results: He was seen in our clinic soon after his discharge from the hospital. Upon further questioning, it became apparent that his CI processor remained in place on his head during the cardioversion. Audiologic evaluation revealed that his aided CNC word score using the same processor dropped to 28%. Internal device impedances were found to be normal. His processor was replaced due to concerns for failure related to current spread occurring during cardioversion. One month following replacement, his CNC word score increased to 82%. Threshold and comfort levels were assessed both before and after processor replacement and were unchanged. Threshold and comfort levels were assessed both before and after processor replacement and were unchanged.

Conclusion: CI processors should be removed prior to any surgical or invasive procedure if there is any uncertainty regarding the impact on the device. Non-otolaryngology perioperative teams, awake procedures and emergent cardiac interventions likely carry a higher risk of oversight resulting in processor damage. In the present case, the processor was able to be replaced with no ostensible negative effect of the patient’s long-term prognosis. This outcome supports the resilience of internal CI components when faced with electrical currents.

Primary Author/Presenter: James Sullivan

Author Block: James C. Sullivan, AuD1, Alex Sweeney, MD1, Cody Page, MD2;1Bobby R. Alford Department of Otolaryngology- Head & Neck Surgery, Baylor Coll. of Med., Houston, TX, 2Dallas Ear Inst., Dallas, TX.

Learner Objectives:
**CI2023 Dallas: Cochlear Implants in Children and Adults**

At conclusion of session, participant will be able to explain appropriate recommendations for monopolar cautery for cochlear implant recipients.

At conclusion of session, participant will be able to discuss literature recommendations for exposure to electrical current for those utilizing cochlear implants.
Abstract Content:

Introduction: In recent years, it has become common practice for providers who serve children who are Deaf/Hard-of-Hearing (DHH) to provide strategies and tips to clients via social media, namely Facebook, Twitter, and Instagram, but also Pinterest, Snapchat, and others (ASHA SIG 9, 2022). The American Speech-Language Association (ASHA) has released information regarding social media use as it pertains to ethics, privacy and confidentiality, civility, and professionalism (ASHA, 2022). However, guidance on evidence-based practice (EBP) for social media's influence on caregiver or provider skill, knowledge, or behavior is not yet established. Given that providers who serve children who are DHH often lack confidence, educational backgrounds and/or experience with this population, there is motivation to better understand if social media content may increase families’ access to resources and information to improve language outcomes of children who are DHH. It is speculated that this is due to the breadth of SLP settings in which social media could be applied, the variability in quality of social media posts and content, as well as the fast-paced, ever-growing, and changing nature of the internet.

Methods: A review of existing literature examining the use of social media was conducted to determine the current availability of published studies. Discussion suggests that social media is a salient and free resource that people already have (rather than having to download another app). In addition, the decreased technological barrier in content creation may be more accessible to both the provider as well as caregivers/providers. Should social media prove to be beneficial in aiding the hearing healthcare team, special consideration on how information is presented is important to explore.

Results: Preliminary results suggest that although this area of research is sparse, the ease of accessibility suggests benefits in the areas of: intervention, clinical information, parent education, and assessment. Interactive visual content can combine elements as it pertains to creating engaging material to support the adult learning process. This includes: Text vs Graphic, Dynamic vs Static, Multiple Modalities, Interactivity, and Engagement. When incorporated effectively, the principles outlined can help guide engagement, attention, and memory for content used for caregiver/provider education and home programming.

Conclusion: The results of this information will have catalyzing effects for providers working with children with hearing loss. It may contribute to increases in illustrating caregiver/provider models asynchronously to enrich programming for current clients as well as reaching individuals who may benefit from programming that would otherwise not be an accessible service.

Primary Author/Presenter: Heather Wulff Tull

Author Block: Heather Wulff Tull, B.A. in Linguistics, Communications1, Kristina M. Blaiser, PhD, CCC-SLP1, Blair Richlin, M.S., CCC-SLP, LSLS AVEd, TSSLD2; 1Communication Sciences & Disorders, Idaho State Univ., Pocatello, ID, 2PhD Rehabilitation & Communication Sciences, Idaho State Univ., Pocatello, ID.

Learner Objectives:

Describe the existing literature supporting use of social media to facilitate education for caregivers and providers.
CI2023 Dallas: Cochlear Implants in Children and Adults

Understand the barriers to social media use to support caregiver/provider knowledge
**Concurrent Recording of the Electrically-Evoked Compound Action Potential and the Auditory Brainstem Response in Cochlear Implant Users**

**Abstract Content:**

Introduction: The acoustically-evoked auditory brainstem response (ABR) is a common objective test of auditory function. One ABR metric of interest is the ratio of the amplitudes of Wave I to Wave V. However, this metric cannot typically be derived in the electrically-evoked ABR (eABR) because artifacts associated with stimulation through the cochlear implant (CI) obscure Wave I. Activity in the auditory nerve of CI users can, however, be assessed using a separate test which measures the electrically-evoked compound action potential (eCAP), equivalent to Wave I of the ABR. Therefore, for CI users, comparison of Wave I to Wave V requires two separate measures. The purpose of this project was to test the feasibility of combining eABR and eCAP measurements into a single test.

**Methods:** Seven MED-EL CI users participated in this study, ranging in age from 25 to 71 years. For each participant, loudness functions were measured for the stimuli associated with the proprietary MAESTRO ART test on up to three electrodes (basal, mid, apical). This eCAP test, which uses a paired-pulse stimulation sequence to cancel out stimulus artifact, also provides a trigger pulse associated with each paired-pulse sequence. This trigger pulse was used to synchronize an Intelligent Hearing Systems ABR unit to simultaneously measure the eABR evoked by a single pulse within the paired-pulse sequence. At fixed loudness levels, eCAPs were measured using the ART test and, simultaneously, eABRs were measured using the ABR unit. To gauge the quality of the eABR evoked using this combined technique, eABRs were also collected for the same loudness levels using the proprietary eABR test within the MAESTRO software package.

**Results:** Robust eABRs were elicited by synchronizing the ABR averager to a single pulse within the ART paired-pulse sequence. The morphology of this eABR compared favorably to the eABR elicited by the specific MAESTRO test. This is noteworthy because the eABR elicited in the combined test was constrained to single-phase stimulation pulses whereas the MAESTRO eABR test uses alternating-phase pulses. The eCAP amplitude measured with ART varied markedly across participants and was often an order of magnitude larger than the Wave V amplitude of the eABR.

**Conclusion:** This study confirmed the feasibility of simultaneously measuring the eCAP and eABR in MED-EL CI users. The eABR measured in the combined test compared favorably with the eABR measured using the MAESTRO test. The variation in eCAP amplitude across participants presents a challenge in deriving a simple metric equivalent to the Wave I/Wave V ratio in acoustic ABRs.

**Primary Author/Presenter:** Matthew Dedmon

**Author Block:** Jenna Van Bosch, BS1, Stacey G. Kane, AuD1, John H. Grose, PhD2, Matthew M. Dedmon, MD PhD2;1Department of Health Sciences, UNC Chapel Hill, Chapel Hill, NC, 2Department of Otolaryngology - Head and Neck Surgery, UNC Chapel Hill, Chapel Hill, NC.

**Learner Objectives:**

Describe the simultaneous measurement of eCAP and eABR in Med-EL CI users.
**CI2023 Dallas: Cochlear Implants in Children and Adults**

**Poster Exhibit Abstract**

**Poster Category:** Technology  
**Poster Exhibit Number:** 133  
**Student Poster Competition?**

**Abstract Number:** 305  
**Poster/Abstract Title:** Effective Integration of Auditory Skills to Improve Complex Language

**Abstract Content:**

**Introduction:** Hearing (DHH) with access to sound earlier than ever. However, access to sound is not enough to fully optimize spoken language outcomes. Children need adults who understand the importance of consistently worn, well-fit hearing technology and how to translate auditory skills into complex language. Unfortunately many providers who serve young children who are DHH and their families are not familiar with auditory skill development, hearing technology, and/or how to integrate hearing into complex language, particularly in children in early intervention settings, when the impact is highest (see reference list). Complicating this even further, families may have access to experienced providers to support language development in their young children with hearing technology. Auditory skill questionnaires are recommended as a primary method for documentation and assessment of auditory skill development (Bagatto et al., 2011b) and can support predictions of language abilities of children 3 years of age (Ching et al., 2013). Yet, when providers do not have the educational background or experience, these assessments are not used meaningfully in intervention and families are not given the support to integrate auditory skills into their daily routines. The goal of this project is to link results from an auditory skill questionnaire to easy-to-interpret and integrate descriptions and activities for families with children who are DHH. This presentation will introduce an asynchronous platform that will be used to equalize families’ access to resources and information to support complex language through auditory skill development.

**Methods:** The LittleEARS® Auditory Questionnaire (LEAQ; Coninx et al. 2009; Tsiakpini et al. 2004) was chosen as the means for measuring auditory skill development because it is a valid and reliable tool that has been norm-referenced on thousands of children and is available in multiple languages. Direct teaching of listening and spoken language skills as well as multimedia examples, strategies, and supports were incorporated into an asynchronous learning platform.

Families/providers will be given access to the “Auditory Pop-Up” and asked to provide feedback on usability and implementation of resources.

**Results:** Previous data demonstrated that providers have less confidence working with young children who are DHH, particularly with linking auditory skills to language development. The Auditory Pop-Up will be completed in November 2022, as part of the Idaho Collaborative Assessment Project and will be shared with families and providers in December 2022-February 2023. Results on the feasibility and usability of this asynchronous “Auditory Pop-Up” will be shared in this presentation.

**Conclusion:** The use of a valid questionnaire can facilitate targeted goals to support family-reported gaps in development. Asynchronous learning provides families the opportunity to learn and practice on their schedule. The content was structured to support 35 questions from the auditory skills questionnaire, with dedicated strategies and supports embedded for each target question. This presentation will share the Auditory Pop-Up content consisting of explanations, directions, static images, videos, dynamic engagement, and the opportunity to build on skills acquired as well as provide an interactive opportunity for conference participants to practice using this tool.

**Primary Author/Presenter:** Kristina Blaiser
Learner Objectives:

Describe current access to materials, supports, and lessons to support families/caregivers of children with hearing loss in their auditory development.

Describe how asynchronous technology supports the auditory outcomes of children who are DHH.
Abstract Content:

Introduction: Spoken language is dependent upon an acoustically rich environment (Sininger et al., 2010). Even with increased timeliness of age of amplification, pediatric hearing loss naturally alters the experiences and opportunities for auditory development (McCreery et al., 2015). Questionnaires often serve as a primary method for documentation and assessment of auditory skill development (Bagatto et al., 2011b). However, many family members/caregivers are unsure of how to interpret information obtained from these measures or how to effectively integrate auditory skills as a way to develop complex language. Our objective is to better understand the effectiveness of asynchronous, simple visual maps in the selection of appropriate auditory goals and activities with children who are DHH.

Methods: The LitlEARS® Auditory Questionnaire (LEAQ; Coninx et al. 2009; Tsiakpini et al. 2004) was chosen as the means for measuring auditory skill development because it is a valid and reliable tool that has been norm-referenced on thousands of children and in multiple languages. A visual decision tree was created for each item on the questionnaire with yes/no questions branching in an easy-to-follow format to direct users to resources. The Auditory Pop-Up is a component of the Idaho Collaborative Assessment Project (Blaiser & Bargen, 2021) and will be piloted with families and providers in December 2022-February 2023. Results on the feasibility and usability of this asynchronous “Auditory Pop-Up” will be shared in this presentation.

Results: Use of Erber’s Hierarchy (1982, 1996) provides families and professionals the opportunity to explore auditory skill development in a structured format. Given that parent ratings of auditory skill development during early infancy can support predictions of language abilities at age 3 (Ching et al., 2013), the use of a valid questionnaire can support parents in using targeted goals to support reported gaps in development. Parents & professionals are able to consider the child’s current skills and follow a decision tree in a simple yes/no format to determine which auditory skills may be beneficial to target.

Conclusion: Although auditory skills questionnaires provide families with information regarding the child’s skill development, the use of additional, supplementary supports such as a decision making tree provide an “end goal” of gaps that need to be filled. Use of decision trees provides the branches for families to understand how targets become goals.

Primary Author/Presenter: Blair Richlin

Author Block: Blair Richlin, M.S., CCC-SLP LSLS AVEd, TSSLD1, Kristina Blaiser, PhD, CCC-SLP2, Shannon Roybal, Bachelor of Arts2, Heather Wulff Tull, Bachelor of Arts2;1PhD Rehabilitation & Communication Sciences, Idaho State Univ., Brooklyn, NY, 2Communication Sciences & Disorders, Idaho State Univ., Meridian, ID.

Learner Objectives:

Describe how a decision tree supports family/caregiver understanding of listening skills integrated into auditory skills questionnaires.
CI2023 Dallas: Cochlear Implants in Children and Adults

Determine how a hearing hierarchy format can help families, caregivers and/or early career providers make decisions on the auditory skills to target in early intervention.
Introduction: The primary objective of this study was to gather subjective feedback on real-world hearing experience and usability of a new sound processor from CI recipients. A secondary objective was to investigate CI programming professionals’ experience with fitting the new processor. Methods: CI recipients who were either newly implanted and had at least 3 months of use experience with the new sound processor or those who had recently upgraded to the new sound processor participated in this ongoing survey. Respondents were adults as well as children (or their parents or care givers). These individuals as well participating CI professionals were located in ten countries (USA, Canada, Chile, United Kingdom, Spain, Italy, Germany, Belgium, Netherlands, and India). Three custom questionnaires were administered in country-specific languages via survey monkey for the three groups (1) newly implanted users, (2) experienced users, and (3) CI programming professionals. Results: Overall, recipients reported high levels of satisfaction regarding their hearing experience in quiet as well as in noise. The sound processor was reported to be easy to use by all ages of recipients and by professionals. The majority of experienced CI users rated the new processor as being similar or better than their previous processor in all areas surveyed. Positive ratings are observed for ease of use, comfort and usefulness of the new functions and features of the CI sound processor. Bluetooth streaming capability was well received and rated highly from speech understanding and perception of streamed media. The ability to wirelessly program the sound processor was the highest rated capability from the programming professionals’ perspective. Conclusion: The benefits provided by new CI sound processor system were found to be meaningful and useful in real-world situations by CI recipients of all ages.