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# Abstract Book

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## Free Paper Session 1 - Tinnitus & Hyperacusis

Prälatensaal, May 15, 2025, 09:00 - 10:30

### DIGITAL THERAPY FOR IMPROVED TINNITUS CARE (DEFINE) STUDY: INCREASING ACCESSIBILITY TO HIGH-QUALITY, EVIDENCE-BASED DIGITAL COGNITIVE BEHAVIOURAL THERAPY FOR TINNITUS PATIENTS

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**Background:** Tinnitus affects approximately 10% of adults worldwide and can significantly impact quality of life. Cognitive behavioural therapy (CBT) is a proven and recommended treatment but is often inaccessible due to cost, availability and workforce limitations with only 2.1% of tinnitus sufferers having access. The DEFINE study is the largest randomized controlled trial to compare whether digital therapy can achieve equivalent outcomes as face-to-face CBT amongst tinnitus patients.

**Methods:** This randomized controlled trial enrolled 210 participants with chronic tinnitus, randomly assigned in a 1:1 ratio to either the Oto digital tinnitus programme (intervention) or Face-to Face therapist-delivered CBT (control). The primary outcome was tinnitus severity, assessed using the Tinnitus Functional Index (TFI) at six months. Secondary outcomes included health-related quality of life (EQ-5D-5L/HUI3), usability (System-Usability-Scale), safety monitoring, and participant satisfaction.

**Results:** At six months, the Oto programme demonstrated non-inferiority to therapist-led CBT, with comparable reductions in tinnitus severity and improvements in quality of life. Preliminary results at 1, 3, and 6 months showed significant reductions in tinnitus-related distress across both groups. High usability ratings underscored the acceptability of the Oto app.

**Conclusion:** The DEFINE trial represents a pivotal step in the evolution of tinnitus treatment. As the largest study of its kind, it demonstrates that digital therapeutics can match the efficacy of therapist-delivered CBT while addressing scalability and cost challenges. These findings have the potential to redefine tinnitus care worldwide, giving millions of people struggling with tinnitus the opportunity for near-instant access to evidence based, effective care without the challenges of traditional face-to-face CBT.

# HEARING AID AMPLIFICATION EFFECT ON TINNITUS

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**Background:**Tinnitus affects millions globally, with a prevalence of 10% to 15% in adults. Tinnitus can severely impact quality of life, leading to emotional distress and discomfort. Despite the fact that hearing aid amplification can change tinnitus perception, there are no clear guidelines for the efficacy of use in tinnitus patients. This study aims to review whether broadband hearing aid amplification, particularly when the amplification includes tinnitus pitch, can reduce tinnitus perception (loudness) and distress (discomfort) in patients with Sensorineural Hearing Loss (SHL).

**Methodology:**A systematic review was conducted by searching the PUBMED database for studies published after 2000, reflecting advancements in hearing aid technology according to certain inclusion criteria. Real-Ear Measurements (REM) verification technique was a substantial inclusion criterion to ensure accurate hearing aid fitting. The PICO framework was used in connection with the "PRISMA 2020 statement" guidelines. The primary measures used to assess tinnitus improvement were THI, TFI, TQ,TRQ and VAS.

**Results:** 80% of the studies showed that patients experienced a statistically significant reduction in tinnitus loudness, particularly when the tinnitus pitch was within the hearing aid's frequency range. Comparably, 100% of the studies demonstrated significant improvements in tinnitus-related. 85% of studies showed clinically significant improvement. The fact that REM was used in every study to confirm the fitting of hearing aids produced positive results, highlighting the significance of customized fitting protocols.

**Conclusion:** The review supports the use of broadband hearing aid amplification, particularly when it includes tinnitus pitch and is verified by REM, as an effective intervention for reducing tinnitus loudness and distress.

# SENSITIVE EARS IN A NOISY WORLD: HYPERACUSIS AND SPEECH PERCEPTION PRELIMINARY RESULTS

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**Background:** There are limited studies on the effect of hyperacusis on auditory perception. This study aims to examine the speech perception of individuals with hyperacusis in noisy environments and compare this performance with a healthy control group.

**Methods:** A total of 48 participants were included in the study (hyperacusis=24 control=24). Participants were matched for age and gender. Participants' speech perception was assessed with the Hearing in Noise Test (HINT) and the Speech, Spatial and Qualities of Hearing Scale-Speech Perception (SSQ SPEP). In addition, the impact of hyperacusis on daily life was assessed with the Hyperacusis Handicap Questionnaire (HHQ).

**Results:** There was no significant difference between the groups in the HINT test results, indicating that both groups exhibited similar speech perception performance in the noise. However, the SSQ SPEP results revealed that the hyperacusis group performed lower than the control group. A moderate positive relationship was found between HHQ and HINT, but no significant relationship was observed between HHQ and SSQ SPEP.

**Conclusion:** This study highlights the complex interaction between hyperacusis and speech perception. Differences in speech perception in noisy environments may be influenced by individuals' psychological and emotional factors. The study emphasizes the importance of future research to further investigate the relationship between burden of hyperacusis and speech perception performance.

**Keywords:** hyperacusis, loudness discomfort level, noise, speech perception.

## HYPERACUSIS IMPROVEMENT FOLLOWING AUDITORY TRAINING

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Hyperacusis, a symptom related to hypersensitivity to sounds, has an estimated prevalence of 9%-15% and leads to impaired social, emotional and attentional functioning. This study explores an intervention method to minimize hyperacusis. The aim of our study was to answer the following research questions: 1. whether hyperacusis can be improved through systematic guided exposure to annoying sounds under experimental controlled conditions and 2. whether temporal resolution can be improved with auditory training. Methods included an initial interview, Khalfa Hyperacusis questionnaire, guided exposure to annoying sounds, temporal resolution pre and post auditory training evaluation. The sample was composed of 33 adults that were split into an experimental hyperacusis group and a control one based on their score at Khalfa's Hyperacusis questionnaire (cut off 16). It was found that the experimental group ameliorated its hyperacusis discomfort ( $p=0.001$ ) as well as improved its temporal resolution for both right ( $p=0.001$ ) and left ears ( $p=0.003$ ). Individuals with hyperacusis can benefit from auditory training both in terms of symptomatology and temporal resolution.

# THE ASSOCIATION BETWEEN HEARING SENSITIVITY AND TINNITUS LATERALITY IN UNILATERAL TINNITUS CASES

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**Background:** Tinnitus, often associated with hearing loss, is a complex condition that can significantly impact daily life. While typically occurring in the poorer-hearing ear, tinnitus has also been reported in the better-hearing ear. This study aims to explore its prevalence, patient-reported tinnitus handicap inventory (THI) scores, and the characteristics of cases with tinnitus in the better-hearing ear.

**Methods:** 35 participants with unilateral tinnitus were included in this study. All participants underwent pure-tone audiometry testing across frequencies from 250 to 12500 Hz and Distortion Product Otoacoustic Emissions. (DPOAEs). Additionally, participants completed the THI questionnaire to assess the impact of tinnitus on their daily lives.

**Results:** Out of 35 participants, 7 experienced tinnitus on the side with better hearing, while 28 reported tinnitus on the side with worse hearing. A chi-square test revealed a statistically significant difference in the distribution of tinnitus between the two sides ( $p < 0.001$ ). Among those with tinnitus on the better-hearing side, all had asymmetrical sensorineural hearing loss, with five having normal hearing in one ear.

**Conclusion:** Most participants experienced tinnitus in the poorer-hearing ear, reinforcing the link between hearing impairment and tinnitus. However, tinnitus can also occur in the better-hearing ear, emphasizing the need for comprehensive audiological evaluations. These findings highlight the importance of tailored treatment plans based on thorough assessments. Future research should explore the underlying mechanisms of tinnitus laterality.

**Key words:** Tinnitus, Tinnitus handicap inventory

## Free Paper Session 2 - Big Data / AI

Room Hartmann, May 15, 2025, 09:00 - 10:30

### HEARING-RELATED COGNITIVE BRAIN AGE: INSIGHTS INTO ACCELERATED BRAIN AGING IN AGE-RELATED HEARING LOSS

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Free Paper Session 5 - Big Data / AI, May 15, 2025, 13:25 - 14:55

**Introduction:** Age-related hearing loss (ARHL) is a common aging condition that impacts speech recognition, communication, spatial awareness, and environmental perception. These changes are linked to alterations in brain networks associated with auditory, visual, memory, and executive functions. Neuroimaging studies have shown that ARHL accelerates structural and functional aging in specific brain regions. However, existing brain age prediction models primarily rely on whole-brain data, lacking focus on domain-specific cognitive functions.

**Methods:** This study developed hearing-related cognitive brain age prediction models targeting global, auditory, memory, executive function, and visual domains. Using gray matter features and AI algorithms, the models analyzed brain images from 36 participants with normal hearing (NH) and 36 with ARHL from the I-Lan Longitudinal Aging Study (ILAS).

**Results:** The models performed well (MAE = 4.55–7.24;  $R^2=0.77-0.91$   $R^2 = 0.77-0.91$ ). ARHL participants showed smaller brain age gaps in global (NH: 4.07 years; ARHL: 1.98 years) and visual domains (NH: 3.32 years; ARHL: 2.14 years), with no significant differences in auditory, memory, or executive domains. In the ARHL group, cognitive brain age was negatively correlated with Mini-Mental State Examination (MMSE) scores ( $\rho=-0.479$   $\rho = -0.479$   $\rho=-0.479$ ).

**Conclusion:** These findings highlight ARHL's role in accelerated cognitive brain aging, particularly in global and visual domains, and provide a framework for domain-specific brain age estimation. This approach could enhance early detection and intervention strategies for ARHL, contributing to improved understanding and management of its cognitive impacts.



# PERFORMANCE OF AN OPEN-SOURCE AUTOMATIC SPEECH RECOGNITION SYSTEM ON DUTCH SPEECH AUDIOMETRY DATA FROM PATIENTS AND FROM A TEXT-TO-SPEECH SYSTEM

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Free Paper Session 5 - Big Data / AI, Room Hartmann, May 15, 2025, 13:25 - 14:55

Background: Dutch speech audiometry in quiet is performed using lists of monosyllabic words following the consonant-vowel-consonant pattern, and is scored on a phoneme level. Presently, the spoken responses of the patients are scored by human examiners. This is a time-intensive process, and therefore costly. Thus, the use of an automatic speech recognition (ASR) system to reliably score the responses, would improve cost efficiency of speech audiometry.

In this study we determined the benchmark of a current open-source ASR system on the scoring of Dutch speech audiometry data. To determine the speaker effect on the performance of the ASR system, we compared patient data (recorded spoken responses) to text-to-speech (TTS) generated data mimicking the patient data. The spoken response can be a word, phoneme or pseudoword. A pseudoword is a phonologically valid sequence of phonemes, which has no meaning.

Methods: We recorded the spoken responses from 95 patients during speech audiometry. The responses were transcribed and scored manually. The transcriptions were used to generate synthetic voice responses using one voice from a TTS system.

An ASR system was used to score the patient and TTS utterances. Phoneme error rate (PER) and word error rate (WER) were calculated for the patient data and TTS generated data. List scores from the ASR system were compared to the results from a human examiner.

Results: This study is ongoing; the results will be discussed in the presentation.

Conclusion: Conclusions will be discussed in the presentation.

# THE ROLE OF ARTIFICIAL INTELLIGENCE IN HEARING AID TECHNOLOGIES

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Free Paper Session 5 - Big Data / AI, May 15, 2025, 13:25 - 14:55

**Background:** Especially in recent years, with the increase in the use of artificial intelligence, innovations are emerging in every aspect of life. Nowadays, many health disciplines are interacting with artificial intelligence. Audiology is one of these disciplines as well. Hearing aids are designed to provide audibility to patients with hearing loss and to improve their quality of life. However, even with the latest technology, the problems faced by patients have not been fully resolved. The extent to which artificial intelligence contributes to hearing technologies is a matter of curiosity.

**Methods:** A literature review of the last five years has been conducted to evaluate the effectiveness of artificial intelligence use in audiology. For this purpose, the PubMed and Google Scholar databases were searched for articles published from 2020 to 2025 as follows: "(Artificial Intelligence)" OR "(Machine Learning)" OR (Deep Learning)" AND "(Hearing Aid)." The PRISMA extension for scoping reviews (PRISMA-ScR) was followed.

**Results:** As a result of the literature review, 31 articles were found. 3 of them were not included because they were not related to the topic.

**Conclusion:** The use of artificial intelligence in the healthcare field certainly provides many benefits to patients and healthcare personnel. The contribution of artificial intelligence to hearing aid technologies has been demonstrated in the studies conducted. However, since the needs of each individual using hearing aids are different, more research is needed in this area.

# THE ROLE OF ARTIFICIAL INTELLIGENCE IN TINNITUS MANAGEMENT

**Research Assistant Yagmur Unal**<sup>1</sup>, Lecturer Sevgi Kadihanoglu<sup>2</sup>

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Free Paper Session 5 - Big Data / AI, May 15, 2025, 13:25 - 14:55

**Background:** Tinnitus is the perception of sounds in the ears or head without any external sound source. Although the etiology of tinnitus is not fully understood, factors such as genetic, immunological, neurological, metabolic, aging, hearing loss, and psychogenic conditions may be underlying causes. The diversity of these underlying factors and individual differences make the diagnosis and management of tinnitus challenging. In this review study, the role of artificial intelligence in the diagnosis and management of tinnitus and its level of success have been investigated.

**Methods:** A literature review of the last five years has been conducted to evaluate the effectiveness of artificial intelligence use in tinnitus management. For this purpose, the PubMed and Google Scholar databases were searched for articles published from 2020 to 2025 as follows: "(Artificial Intelligence)" OR "(Machine Learning)" OR (Deep Learning)" AND "(Tinnitus)." The PRISMA extension for scoping reviews (PRISMA-ScR) was followed.

**Results:** As a result of the literature review, 87 studies were obtained, but 32 were excluded because they were not related to the topic.

**Conclusion:** In studies conducted, it has been observed that the use of artificial intelligence and machine learning plays an effective role in the diagnosis and management of tinnitus. The diversity of tinnitus, the differences in individual characteristics, and the existence of various treatment methods can also lead to a variety of methods provided by artificial intelligence. More research needs to be conducted in this area, and evaluations must be carried out under the supervision of an audiologist.

## Poster Pitch Session 1

Poster Area (Garderoobe 1), May 15, 2025, 10:35 - 11:05

### OUTCOMES OF COCHLEAR IMPLANTATION IN PATIENTS WITH FAR-ADVANCED OTOSCLEROSIS WHO HAD PREVIOUSLY UNDERGONE STAPES SURGERY

**Prof. Piotr Henryk Skarzynski**<sup>1,2</sup>, Andrzej Pastuszek<sup>3</sup>, Elzbieta Gos<sup>1</sup>, Prof. Artur Lorens<sup>4</sup>, Aleksandra Kolodziejak<sup>1</sup>, Anita Obrycka<sup>4</sup>, Marek Porowski<sup>3</sup>, Henryk Skarzynski<sup>3</sup>

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**Background:** The aim of this study was to assess the hearing outcomes in cochlear implant patients with far-advanced otosclerosis who had previously undergone stapes surgery.

**Methods:** We studied 17 implanted patients with far-advanced otosclerosis who had previously undergone stapes surgery. Pure-tone audiometry (0.125-8 kHz) was performed preoperatively and at 1, 6, and 12 months postoperatively. Free-field speech audiometry was conducted before and 12 months after surgery, and word recognition scores were assessed.

**Results:** Average preoperative hearing thresholds were 108 dB HL for air conduction and were at the limit of the audiometer for bone conduction. Word recognition scores before surgery averaged 7.4% (at 70 dB) and increased significantly to 66.2% about 12 months after surgery. Adverse surgical events were rare.

**Conclusion:** Patients with far-advanced otosclerosis and who had previously undergone stapes surgery are likely to experience a deterioration in hearing and receive insufficient benefits from hearing aids. Cochlear implantation can improve their hearing and provide good speech understanding.

# CHARACTERISTICS OF AUDITORY AND VESTIBULAR SYMPTOMS IN PATIENTS WITH MENIERE`S DISEASE

**Ass Prof Md Phd Marisa Klančnik**<sup>1</sup>, Md Phd Petar Ivanišević<sup>1</sup>, Md Phd Filip Vučemilović<sup>1</sup>, Md Phd Marina Radoš<sup>1</sup>

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**Background:** The research objectives were to examine which are the most common audiovestibular symptoms and audiometry and vestibulometry findings of Meniere's disease in relation to each stage, and to assess variations associated with age and gender

**Methods:** The materials consisted of anamnestic data and audiometry and vestibulometry findings sourced from registrar of Audiology department

The subjects were divided into two groups depending on gender and age, and into four groups depending on the stage of the disease

**Results:** : In the first and second stages the most common symptoms are vertigo, hearing fluctuations and tinnitus, and in the third stage vertigo, tinnitus and aural fullness. In the fourth stage, the most common symptom is tinnitus. In the first and second stages, the ascending type of curve is the most common, while in the third and fourth stages, it is the flat type. The younger group has a significantly higher frequency of vertigo attacks and hearing fluctuations, while the older group has more frequent vestibular hypofunction and a higher average hearing loss compared to the younger group. There are differences in curve types in relation to gender and age

**Conclusion:** With the progression of the disease, along with aging, we see a decrease in the frequency of hearing fluctuations and vertigo and an increase in the average hearing loss and the frequency of vestibular hypofunction. The ascending type of curve is more common in earlier stages and in younger subjects, while the flat type is more common in later stages and in older subjects

# EVALUATION OF INDIVIDUALS WITH TINNITUS COMPLAINTS USING TINNOMETER AND IMPLEMENTATION OF HEARING AID-BASED TINNITUS THERAPY METHODS

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**Background:** Tinnitus, from the Latin *tinniere* meaning "to ring," is the perception of sound without an external source, often manifesting as ringing, buzzing, or clicking sounds. It significantly impacts quality of life and can be caused by factors such as loud noise exposure, ototoxic medications, and age-related hearing loss. Technological advancements like the Tinnometer allow for precise frequency assessment and tailored masking sounds, offering effective treatment options.

**Methods:** This study evaluated tinnitus complaints using the Tinnometer and hearing aids for therapy. Twenty-six participants (20 males, 6 females; aged 18-80) with persistent tinnitus ( $\geq 6$  months) were included following ethical approval (Protocol: E-10840098-772.02-6791). The Tinnitus Handicap Inventory (THI) was administered pre- and post-therapy to measure changes in tinnitus perception. Tinnitus mapping identified frequency, residual inhibition, and masking frequency. Therapy was delivered through Bluetooth-enabled hearing aids providing personalized masking sounds, with fittings tailored to each patient. Statistical analyses included dependent/independent T-tests, Kruskal-Wallis, and One-Way ANOVA using SPSS v20.0, with significance set at  $p < 0.05$ .

**Results:** Significant reductions in tinnitus discomfort were observed after therapy. The Tinnometer's frequency identification and individualized masking through hearing aids led to improved patient satisfaction. Personalized therapies were more effective than generalized approaches, with social and psychological factors also influencing outcomes.

**Conclusion:** Tinnometer and hearing aid-based therapies are effective for tinnitus management. The subjective nature of tinnitus necessitates personalized treatment strategies, and further research is needed to refine therapies and address individual variability.

**Keywords:** Tinnitus, Tinnometer, Hearing Aid, Tinnitus Therapy, Individualized Treatment.

# VALIDATION OF THE SWEDISH VERSION OF THE TINNITUS FUNCTIONAL INDEX TINNITUS AND HYPERCUSIS

**Anna Kall**<sup>1</sup>, Maryam Tammelin<sup>1</sup>, Maria Hoff<sup>1</sup>

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**Background:** Tinnitus affects up to 15% of the adult population globally, of which a proportion experiences a severe form of it. TFI-SE is the Swedish-language version of the Tinnitus Functional Index (TFI), a self-report instrument for measuring the degree of tinnitus discomfort and the effect of rehabilitation.

**Methods:** The study used a mixed method approach. The quantitative part assessed the sensitivity of TFI-SE to treatment-related changes in patients (responsiveness) through prospective longitudinal data collection. The qualitative part involved focus group interviews with audiologists to evaluate their experiences of using TFI-SE in clinical settings.

**Results:** At follow-up, the average TFI score decreased from 66,4 to 47,8 ( $p < 0,001$ ) indicating a significant improvement in tinnitus complaints. Large effect-size were observed for most sub scales and effect sizes were larger in patients who reported an experience of improvement on a visual analogue scale. The qualitative data indicated both positive and negative aspects of using TFI-SE, with an overall positive reception among audiologists.

**Conclusions:** The TFI-SE is a useful tool for measuring the outcomes of tinnitus rehabilitation. The results of this study support the use of TFI-SE to standardize the evaluation of tinnitus interventions and contribute to more uniform and equitable care. Further research is recommended to explore the instrument's utility in different patient groups and clinical settings

# SOUND LOCALIZATION AND PATIENTS' SATISFACTION IN SSD-CI USERS

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Background: Since 2011 single sided deafness (SSD) is an indication for Cochlear Implantation (CI). To evaluate the implantation in SSD different setting for hearing in noise and sound localisation abilities together with an subjective evaluation of their performance via questionnaires were implemented.

Methods: All measurements were performed in the unaided SSD condition (SSD) and in the CI aided SSD condition (SSD-CI). Benefit of speech understanding in noise was tested with the adaptive OLSA (SONO). For the sound localization test, a seven loudspeakers cemicircle setup was used. To demonstrate the individual failure a Root Mean Score Error (RMSE) and the bias was calculated. To evaluate the patients' quality of hearing and satisfaction two questionnaires were used. The first, was the "Abbreviated Profile of Hearing Aid Benefit questionnaire" called APHAB. The second questionnaire used was the "Speech, Spatial and Qualities of Hearing Scale", (SSQ12). Inclusion criteria was based on manufacturers recommendation and additionally patients had to have stable hearing loss (>1year) , aged 18 years or older and required CI experience of at least one year.

Results: The results for the ten SSD-CI patients showed significant improvements after Cochlear implantation in all tested categories: in speech understanding in noise with the OLSA in the condition SONO, in sound localization with seven speakers as well as in the two different questionnaires, the APHAB and the SSQ12, ( $p < 0,05$ ).

Conclusion: CI in SSD should be the method of choice to rehabilitate patients hearing, given the medical preconditions for such an operation exist.



## Free Paper Session 3 - Auditory Implants (Part 1)

Herrensaal, May 15, 2025, 13:25 – 14:55

### IMPACT OF COCHLEAR DIMENSIONS ON AUDIOMETRIC OUTCOMES IN COCHLEAR IMPLANTATION WITH A STANDARD ELECTRODE

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**Background:** Cochlear implants have transformed auditory rehabilitation for individuals with hearing loss. However, the uniform design and fixed length of implants may not account for the anatomical variability of the cochlea, potentially affecting audiometric outcomes. Understanding the relationship between implant dimensions, cochlear size, and audiometric performance is critical to optimizing outcomes.

**Methods:** This retrospective study analysed 40 patients implanted with the same cochlear implant model with standard electrode. Preoperative computed tomography scans of the temporal bone (slice thickness <1mm) were analyzed by OTOPLAN software. Audiometric performance was evaluated through pure-tone audiometry. Correlations between implant dimension, cochlear dimensions, and audiometric outcomes were analysed.

**Results:** Preliminary findings indicate variability in cochlear dimensions across patients. Initial analyses suggest that a mismatch between implant length and cochlear duct length may influence audiometric outcomes. Comprehensive results are currently being compiled for final analysis.

**Conclusion:** This study underscores the importance of anatomical considerations in cochlear implant design. Aligning implant dimensions with individual cochlear anatomy could enhance audiometric performance and patient satisfaction. These findings may inform future implant designs and surgical practices.

# FINE HEARING AND THE APICAL REGION: THE RATIONALE FOR LONG CI ELECTRODES WITH FINE STRUCTURE STIMULATION

**MD PhD Paul Van de Heyning**<sup>1</sup>

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Background: Experiments explored the added value of electric stimulation of the spiral ganglion apex in the second turn of the cochlea. The aims are to evaluate: 1.the auditory percept with deep electrode insertion 2.speech-in-noise (SPIN) values with apical phase locked electric stimulation (Fine structure Processing FSP) 4.a new electric-acoustic stimulation(EAS) paradigm with deep insertion of flexible lateral wall electrodes.

Methods: Aim 1, pitch matching experiments with a CI in single sided deafness (SSD). Aim 2 bilateral profound hearing loss patients with one CI comparing Continuous Interleaved strategy(CIS) with FSP. Aim 3 literature review applied on adaptive fitting software.

Long and medium flexible lateral wall electrode CI arrays were used (MED-EL, Flex24, Flex 28 and Flex Soft).

Results: Electrical pitch percepts corresponding to pure tones from 100 to 300 Hz, could only be elicited by applying corresponding low rate electrical stimulation on electrodes beyond 540° degrees angular insertion depth.

Prospectively comparing FSP versus CIS in the apex yields better SPIN.

Flex electrode length does not influence hearing preservation.

Hearing preservation with Flex 24, Flex28 and Flexsoft are similar . The adaptive strategy in programming software allows varying residual hearing conditions.

Conclusions: Electric CI stimulation 540° with FSP realizes clear low tone perception, better SPIN and music quality, supporting Flex 28 and Flexsoft with apical FSP. Also, for EAS long electrodes are advocated.

# EFFECT OF A NOISE REDUCTION ALGORITHM ON SPEECH RECOGNITION AND LISTENING EFFORT IN NOISE IN COCHLEAR IMPLANT USER

**Dr. Verena Müller**<sup>1</sup>, Amanuel Ukuwait<sup>1</sup>, Katrin Frößler<sup>1</sup>, Ruth Lang-Roth<sup>1</sup>

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**Background:** In order to improve speech recognition of cochlear implant (CI) users in noisy situations, pre-processing mechanisms such as noise reduction (NR) algorithms can be used. The manufacturer MED-EL integrated a transient and an ambient NR in their SONNET 2 audio processor. This study investigated the effect of the activated NR on both, speech recognition and subjective listening effort, as a function of different noise signals.

**Methods:** 20 postlingually deafened, adult CI users were included in the study. Speech recognition and listening effort were measured in presence of four different noise signals, ranging from stationary to fluctuating noises including a speech masker. The NR was once deactivated and once activated. The signals were presented from  $S0N\pm 135$ . Patients had bilateral hearing loss and were fitted with unilateral, bimodal or bilateral CI. Regardless of the treatment mode, only one CI side was measured.

**Results:** Speech recognition improved in presence of one stationary noise and one fluctuating noise when the NR was activated. The improvement did not only depend on the characteristics of the respective noise signal being stationary or fluctuating but seemed to rely also on their frequency distribution. The subjectively perceived listening effort was unaltered regardless of the NR being deactivated or activated.

**Conclusions:** The activated NR in the SONNET 2 audio processor improved speech recognition in parts. Listening effort was equal. As there was no deterioration in any situation with the activated NR, it could be recommended to use the NR in corresponding everyday situations.

This study was supported by MED-EL Deutschland GmbH

## LONGITUDINAL CHANGES IN ELECTRICAL STAPEDIUS REFLEX THRESHOLDS (eSRT) IN CHILDREN WITH COCHLEAR IMPLANTS

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Free Paper Session 3 - Auditory Implants (Part 1), Herrensaal, May 15, 2025, 13:25 - 14:55

**Background:** The electrically evoked stapedius reflex threshold (eSRT) can be used as a tool to estimate the maximum comfort level (MCL) during the fitting of cochlear implants (CI), especially in children and toddlers. This study examined the long-term changes in eSRT over a ten-year observation period.

**Methods:** A retrospective analysis was conducted on data from 26 children with cochlear implants (50 ears). The data included charge units (QU) required to evoke the stapedius reflex. Time-series statistical methods were applied to assess trends in QU values and their variance, normalized to individual baselines.

**Results:** The mean QU values significantly increased during the first six months post-implantation and then stabilized. Variance in eSRT decreased substantially over the first five years, with three key milestones observed at six months, 18 months, and 4.25 years, reflecting a consistent decline in variability over time.

**Conclusion:** CI fitting schedules should align with the temporal changes in eSRT variance. Frequent fittings are recommended during the first 18 months, followed by annual adjustments until the fourth year post-implantation. Beyond this period, less frequent fittings may suffice.

## TAILOR MADE IMPLANTATION: THE IMPORTANCE OF ADEQUATE ELECTRODE SELECTION IN CI SURGERY

**Professor Javier Gavilan**<sup>1</sup>, Doctor Jose Manuel Morales, Luis Lassaletta

<sup>1</sup>Otorhinolaryngology, La Paz University Hospital, Madrid, Spain

**Background:** Cochlear implant (CI) electrode insertion is one of the key steps in CI surgery. This study will assess the importance of structure preservation and gain insight on the complications related to different types of electrode arrays.

**Methods:** By means of a systematic electronic search of the literature using PubMed the main complications related to CI electrode arrays has been assessed. Tip fold-over (TFO), electrode scalar deviation (SD), electrode migration, and electrode angular insertion depth (AID) for both pre-shaped and straight electrode types are documented.

**Results:** A total of 126 studies including 10,224 ears implanted with CI were combinedly taken in the evaluation of incidence rate of electrode TOF, SD, migration and AID provided by the electrode types. An incidence rate of 5.3% of electrode TFO, 28.7 % of electrode SD, 0.54 % of electrode migration is associated with pre-shaped electrodes, whereas with straight lateral wall electrodes it was 0.51 %, 11.2 % and 5.1 % respectively. Pre-shaped electrodes provide an average AID of 385° whereas straight lateral wall electrode of length 28mm provide an average AID of 548° and a 31.5 mm long electrode provide an average AID of 610°. Straight electrodes of 24-25mm provide an average AID of 418° which is close to the AID of pre-shaped electrodes of the same length.

**Conclusions:** The use of straight lateral wall electrodes appears to be more atraumatic to the intracochlear structures compared to pre-shaped electrodes. Insertion depths of more than 500° have only be reported for long (28 and 31mm) lateral wall electrodes.

# THE FRENCH VERSION OF THE CIQoL-35 QUALITY OF LIFE QUESTIONNAIRE IN ADULT COCHLEAR IMPLANT USERS

**Isabelle Mosnier**<sup>1</sup>, Daphnée Yin, Evelyne FERRARY, Michel HOEN, Chadlia Karoui

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**Background:** The Cochlear Implant – Quality of Life (CIQoL) is a patient-reported outcome measure assessing quality of life (QoL) in adult cochlear implant (CI) users across six domains: Communication, Emotion, Entertainment, Environment, Listening Effort, and Social. Available in two versions, CIQoL-35 (35 items) and CIQoL-10 (10 items), it was recently translated and adapted from English to French. This study aims to evaluate the measurement properties of the French CIQoL.

**Methods:** Fifty adult CI users completed the CIQoL questionnaire. Domain scores and both CIQoL-10 and CIQoL-35 were analyzed. Principal Component Analysis (PCA) was performed to assess construct validity, while internal consistency was evaluated using Cronbach's alpha. Convergent validity was explored through correlation matrices.

**Results:** The Social domain received the highest score (mean: 78.8% ± 14.4%). Mean scores for CIQoL-10 and CIQoL-35 were 55.8% (± 9.2%) and 62.8% (± 11.5%), respectively. The CIQoL-35 showed excellent internal consistency (Cronbach's alpha = 0.937). The Communication domain had high consistency (0.892), while the Emotion domain was the lowest (0.694). No negative correlations were found between domains. PCA confirmed overall construct validity, though the Emotion domain demonstrated some divergence, suggesting it interacts differently from the other domains.

**Conclusion:** The French CIQoL provides a valuable tool for assessing CI-related QoL, helping healthcare professionals understand patients' experiences and tailor treatments to alleviate discomfort.

## COCHLEAR IMPLANTATION IN CHILDREN WITH SINGLE-SIDED DEAFNESS

**Prof. Artur Lorens**<sup>1</sup>, Ass. Prof. Anita Obrycka<sup>1</sup>, PhD Anna Ratuszniak<sup>1</sup>, Prof. Piotr H. Skarżyński<sup>1,2</sup>, Prof. Henryk Skarżyński<sup>1</sup>

<sup>1</sup>World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany, Poland, <sup>2</sup>Institute of Sensory Organs, Kajetany, Poland

**Background:** To evaluate hearing outcomes after cochlear implantation (CI) in children with single-sided deafness (SSD).

**Methods:** The Adaptive Auditory Speech Test (AAST) was administered in 33 children with congenital SSD, mean age at CI of 5.6 years (SD = 3.2). Monosyllabic word tests were performed in 20 children with acquired SSD (mean age at CI = 13.2 years, SD = 2.8). Three binaural effects were measured (redundancy, head shadow effect and squelch) by comparing speech tests results in conditions 'CI on' and 'CI off'.

**Results:** For two out of three binaural effects, the children with congenital SSD showed significantly better speech perception in the 'CI on' condition compared to the 'CI off' situation: by 1.2 dB SNR for the redundancy ( $t(32) = 3.97$ ;  $p < .001$ ) and by 2.8 dB SNR for the head shadow ( $t(31) = 3.86$ ;  $p < .001$ ). However, for squelch they had similar scores for both the 'CI on' and 'CI off' conditions. Children with acquired SSD showed significantly better word recognition scores in the 'CI on' condition than in the 'CI off' condition for all loudspeaker configurations. The mean improvement was 11.3 percentage points (p.p.) for redundancy ( $t(19) = 5.04$ ;  $p < .001$ ), 8.3 p.p. for head shadow ( $t(19) = 2.88$ ;  $p = .010$ ), and 10.0 p.p. for squelch ( $t(19) = 3.65$ ;  $p = .002$ ).

**Conclusion:** Children with both congenital and acquired single-sided deafness (SSD) benefit from their cochlear implants (CI) in terms of speech perception in noise.

# WHICH FACTORS AFFECT THE DECISION TO UNDERGO COCHLEAR IMPLANTATION?

**Anne Hast**<sup>1</sup>, Dr. Tim Liebscher, Ulrich Hoppe

<sup>1</sup>Friedrich Alexander University Erlangen Nürnberg, Erlangen, Germany

**Background:** Indication criteria for cochlear implantation in Germany changed over the last decades: consequently, an increasing number of patients have the opportunity to benefit from the implantation of this inner ear prosthesis. Nonetheless, the rate of identified CI candidates who pursue implantation after extensive diagnostics is only about 50% in our centre. The aim of this retrospective study was to identify factors that influence the decision in favour of or against implantation.

**Methods:** We retrospectively reviewed preoperative data from 416 patients who underwent CI candidacy evaluation at our centre between 2020-2022. This data included demographics, medical reports, audiological results and a detailed questionnaire concerning the personal assessment of the hearing ability in different situations. For all candidates reimbursement was assured. Cochlear implantation was performed in 204 patients, 212 patients declined implantation: comparisons between these groups were performed.

**Results:** The statistical comparison of the two groups of implanted and non-implanted CI candidates showed that age and tinnitus strength do not influence the decision process, whereas people who opt for a CI show a worse binaural monosyllable understanding ( $p < 0.005$ ), perceive themselves to have more problems talking to several people ( $p < 0.005$ ) and have greater problems when using the telephone ( $p < 0.005$ ). Patients with unilateral deafness are more likely to decide against CI implantation ( $p < 0.005$ ).

**Conclusion:** Even though outcome analysis impressively demonstrates the improvements in CI hearing, only about 50% of the CI candidates pursue implantation. It remains an essential task of CI care centres to address and identify obstacles that cause patients to refrain from CI implantation.



## Free Paper Session 4 - Auditory Objective Measures (Part1)

Prälatensaal, May 15, 2025, 13:25 - 14:55

### INVESTIGATING CORTICAL RESPONSES TO SPECTRAL CUES FOUND IN SPEECH: CONFOUNDING EFFECTS OF LOUDNESS?

**Mats Rekswinkel**<sup>1</sup>, Associate Professor Jens Hjortkjær<sup>1</sup>, Associate Professor Abigail Kressner<sup>1,2</sup>, Scientist Jaime Undurraga<sup>3</sup>

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**Background:** The acoustic change complex (ACC) is a cortical response that can be recorded in response to frequency changes. However, changes in frequency can affect loudness perception and concomitant responses to loudness changes may confound the ACC. Auditory steady-state responses' (ASSRs) correlation with loudness perception is known, but the effect of loudness on the ACC to frequency changes is unknown. Here, the effects of loudness and frequency changes on 40-Hz ASSRs and ACCs, as well as a proposed novel approach to reduce the loudness influence on ACCs to frequency changes are investigated.

**Methods:** First, 26 young normal-hearing participants were instructed to balance different tonal pairs in loudness. ASSRs and ACCs were then recorded to the same tones at either loudness-balanced or mismatched loudness levels. For some conditions stimuli were modified through low-frequency (<4 Hz) random envelope modulation—amplitude roving. Random envelope roving was introduced reasoning that thereby cortical neurons should respond less robustly to loudness changes than simultaneous spectral changes.

**Results:** ASSR amplitude followed loudness level, regardless of roving, and decreased with increasing carrier frequency. Both frequency and loudness changes evoked significant ACCs, with larger responses to frequency changes. Roving decreased the ACC amplitude both to frequency and loudness cues, but more strongly for loudness, with the number of significant ACCs reduced to near chance level.

**Conclusions:** Loudness and frequency cues were found to affect both ASSRs and ACCs. However, frequency changes evoked larger ACCs. Applying the proposed roving approach reduced—to a great extent—the effect of loudness on cortical responses to these frequency changes.

# PREDICTIVE VALUE OF EARLY ABR TESTING IN CHILDREN WITH LANGUAGE/COMMUNICATION PATHOLOGY

**Dr. Ivana Aras<sup>1</sup>**, MD Radana Drvis Ninkovic<sup>1</sup>

<sup>1</sup>SUVAG Polyclinic for Rehabilitation of Listening and Speech, Zagreb, Croatia

**Introduction:** The connection between pathology of hearing and speech language pathology is widely known, but recognizing the sounds of speech and acquiring language involves neural structures far beyond the peripheral sensory organ of hearing.

**Aims:** The aim of the study was to estimate the predictive value of ABR latencies in connection to language and communication pathology.

**Materials and methods:** The participants of the study were 50 children between 2 and 3,6 years, with nonspecific language/communication delay. Only children with TG type A and normal peripheral hearing measured by ASSR were involved in the study. Supraliminal ABR testing was performed in usual conditions during sleep, and absolute and interpeak latencies of the waves I, III and V were observed.

At the age of 4-5 ys, children were tested with standardized language tests, tests of psychomotor development, and were examined by child psychiatrist and pediatric neurologist if needed. According to the findings, they were subdivided in several groups: 1. children with DLD, 2. children with psychomotor retardation, 3. children with autism spectrum disorder (ASD), and 4. children without significant language pathology. Statistical analysis examined the connection between prolongation of ABR latencies and type of pathology.

**Results:** Preliminary results show that the prolongation of ABR latencies is mostly seen in group of children with ASD, less in DLD, and very rare in children with psychomotor retardation. The results show that auditory brainstem response (ABR) is an electrophysiological measure of a part of the hearing pathway that can have a predictive value considering future communication and language development.

# THE INFLUENCE OF INTRAOPERATIVE AUDITORY BRAINSTEM RESPONSES ON VIBROPLASTY COUPLING-QUALITY AND ANALYSIS OF THE IMPACT OF DIFFERENT FIXATION STEPS ON THE COUPLING

**Priv. Doz. Dr. Med. Univ. Daniel Dejaco**<sup>1</sup>, Priv. Doz. Mag. Dr. David Riedl<sup>2</sup>, Dr. med. univ. Timo Gottfried<sup>1</sup>, Dr. med. univ. Matthias Santer<sup>1</sup>, Priv. Doz. Dr. med. univ. Annette Runge<sup>1</sup>, Priv. Doz. Dr. Josef Seebacher<sup>3</sup>, Dipl. Ing. Philipp Zelger<sup>3</sup>, Dr. Lia Bicego<sup>4</sup>, Assoz. Prof. Priv. Doz. Dr. med. univ. Joachim Schmutzhard<sup>1</sup>

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**Purpose:** The VSB is an established active-middle-ear-implant for patients with moderate-to-profound hearing-loss. This surgery is referred to as “Vibroplasty”. Sufficient transfer of the VSB’s FMT energy to the inner ear is a crucial factor influencing the coupling-quality (CQ). However, assessing CQ is hamper by two issues: the method of CQ-assessment itself and the method of FMT-fixation during Vibroplasty.

**Methods:** This prospective study explored the influence of intraoperative auditory-brainstem-response (+ ABR) measurements and various fixation methods on postoperative CQ after Vibroplasty as compared to matched-patients after Vibroplasty without intraoperative ABR (-ABR). Propensity-score-matching was performed based on preoperative bone-conduction-pure-tone-average-3 (BC-PTA3) at 1-, 2- and 4 kHz. Primary outcome parameters were postoperative CQ-PTA3, intraoperative ABR threshold for various fixation methods and postoperative BC-PTA3.

**Results:** A total of 28 patients were included, of which 14 were + ABR. Preoperative BC-PTA3, sex, age, and number of previous surgeries did not differ significantly between groups (all  $p > 0.301$ ). Mean postoperative CQ-PTA3 was significantly better for + ABR (1.8 vs. 12.3 dB-HL;  $p = 0.006$ ). Mean intraoperative ABR threshold was superior for cartilage-counter-bearing and cartilage-housing compared to additional fixation with injectable-platelet-rich- fibrin (53 vs. 56 & 57 dB-HL, respectively;  $p = 0.04$ ;  $\eta^2 = 0.33$ ). Mean postoperative BC-PTA3 did not significantly differ between patients (41.4 vs. 41.8 dB-HL;  $p = 0.77$ ). A total of 7% of the patients required intraoperative readjustment of the FMT based on unsatisfactory intraoperative ABR threshold.

**Conclusion:** Intraoperative ABR measurement resulted in significantly better postoperative CQ. Cartilage-counter-bearing and cartilage-housing were observed to have superior CQ.

# EVOKING AND RECORDING ELECTRICAL AUDITORY CORTICAL EVOKED POTENTIALS DIRECTLY THROUGH THE PEDIATRIC AND ADULT COCHLEAR IMPLANT SYSTEMS.

**Prof. Joseph Attias**<sup>1</sup>, MA, Eng Suhail HabbAllah<sup>1</sup>, PhD Chen Chen<sup>2</sup>

<sup>1</sup>University Of Haifa, Haifa, Israel, <sup>2</sup>Department of Research & Technology, Advanced Bionics LLC, , Valencia, , California, USA

**Background and Aims:** This study aimed to validate electrical stimulation and recording of Auditory Cortical Evoked Potentials (eACEPs) directly through cochlear implants (CIs) in children and adults. It evaluated stimulation level effects, similarity to scalp-recorded eACEPs, test-retest repeatability, and preliminary clinical applications.

**Method:** Twenty children and seven adults with bilateral Advanced Bionics CIs participated. Electrical stimulation was applied to the apical electrode of one CI, while eACEPs were recorded from the basal electrode of the contralateral CI. Each sweep included a 600 ms baseline and signal recording at the most comfortable level (MCL). Signals were amplified, sampled at 5625 Hz, filtered, and analyzed offline. A minimum of 150 sweeps were collected.

**Results:** eACEPs were obtained from all participants across all stimulus levels, showing obligatory P1-N2 peaks. Good repeatability was observed within and between sessions. Decreasing stimulus levels increased latencies and/or amplitudes. CI-recorded eACEPs correlated well with scalp-recorded eACEPs in latencies but showed higher amplitudes. Postlingual adults exhibited delayed eACEP latencies compared to prelingual implanted children. Children with poor CI performance showed significantly delayed and lower eACEP amplitudes compared to high performers.

**Conclusions:** This study demonstrated successful electrical stimulation and recording of eACEPs in children using only the CI system. CI eACEP had higher amplitudes as compared to scalp recorded, most probably due to its proximity to brain auditory generatots and better conductivity volum. A significant association was found between eACEP and CI performance. This innovative technology could significantly impact clinical practice, including hearing diagnostics, CI fitting optimization, and monitoring auditory brain development post-implantation.

## NEW APPROACH TO STAPEDIUS REFLEX FITTING IN COCHLEAR IMPLANT PATIENTS

**Assoc. Prof. Priv. Doz. Dr. Dominik Riss<sup>1</sup>**, Dipl.-Ing. Rudolfs Liepins<sup>1</sup>, B.Sc. Damaris Platzer<sup>3</sup>, Dr. Anke Tropitzsch<sup>2</sup>, Prof. Dr. Hubert Löwenheim<sup>2</sup>

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**Background:** It is necessary to objectify the fitting process of cochlear implant (CI) patients, especially if they are young children or patients with communication impairments. Electrically evoked stapedius reflex thresholds (ESRT) measured with 226 Hz and pressurization have shown a good correlation with the maximal comfortable loudness levels (MCLs). However, the pressurization requires an airtight seal, making the measurement vulnerable to motion and possibly causing discomfort. A novel method using no pressurization and an optimized probe tone frequency was evaluated. The aim was to assess if this method would show similar correlation to MCLs set using behavioural methods.

**Methods:** Included were forty-four adults and pediatric CI-users (older than 18 months) that were implanted with a CI for at least six months and had elicitable stapedius reflexes. ESRT fittings were performed using a commercially available tympanometer as well as with the novel method. Success rate and threshold differences were compared to another, and to a map created using behavioural fitting.

**Results:** ESRTs could be measured in ~82% of the channels using the novel method and in ~89% using the commercially available device. This was similar in all age groups. In adults, the thresholds of both methods showed high correlation with the behavioural fitted maps, while having in average lower threshold in the medial channels.

**Conclusion:** The pressure-less method could decrease the time needed to assess ESRTs in children when sealing is an issue. Despite a slightly lower success rate, it shows similar thresholds and could offer a viable alternative for ESRT assessments.

## DOES IMPEDED BIOMECHANICS INFLUENCE COCHLEAR IMPLANT HEARING PRESERVATION?

**Dr Adam Walkowiak**<sup>1</sup>, Prof. Artur Lorens<sup>1</sup>, Dr Marek Polak<sup>2</sup>, Prof. Piotr Skarżyński<sup>1</sup>, Prof. Henryk Skarżyński<sup>1</sup>

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**Background:** The primary objective of this study is to evaluate if impeded biomechanics affects the hearing preservation after cochlear implantation.

**Methods:** Seventeen adults were implanted with cochlear implants with different electrode lengths. Each of the subjects were implanted using the round window insertion technique. Intracochlear acoustically evoked potentials were recorded from the cochlear implant electrodes. Tone pip of frequency 500Hz was presented from the inserts and generated by the evoked potentials system. Postoperative CT was performed and evaluated. The audiogram prior the implantation was compared with the audiogram performed at the testing.

**Results:** Nine patients had the highest amplitude response to 500Hz tone pip maximum peak matching the 500Hz excitation area evaluated by the postoperative CT. The impeded biomechanic of basilar membrane was observed in 8 patients. These eight patients had the highest amplitude to 500Hz tone pip either apically (1 case) or basally shifted (7 cases) from the 500Hz excitation area evaluated by the postoperative CT. Low frequency pure tone average drop for the tonotopy group of subjects was 12.4dB, while for the group with impeded biomechanic was 8.4dB. No difference in mean was found.

**Conclusion:** These preliminary data suggest that impeded biomechanics of basilar membrane does not necessary influence hearing preservation.

## Free Paper Session 5 - Basic & Translational Research

Room Hartmann, May 15, 2025, 13:25 - 14:55

### CANDIDATE SERUM BIOMARKERS FOR PERMANENT CONGENITAL HEARING LOSS

**Yanin Bovonkitcharoennon**<sup>1</sup>, James Jupp<sup>1</sup>, PhD Derek J Hoare<sup>1,2</sup>, MB ChB, MD Dulip S Jayasinghe<sup>3</sup>, Karen R Willis<sup>4</sup>, PhD Sally K Thornton<sup>1,2</sup>

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Background: Children admitted to neonatal intensive care units (NICUs) face a ten-fold higher risk of permanent congenital hearing impairment (PCHI). While risk factors for PCHI are well-studied, data on PCHI serum biomarkers remain limited. Identifying relevant biomarkers could enable appropriate neurodevelopmental follow-up and, if modifiable, provide opportunities for targeted interventions to reduce PCHI.

The primary objective of this study is to discover which serum biomarkers are predictive and prognostic of PCHI.

Methods: Retrospective biomarker data were abstracted from NHS databases and included 24 serum biomarkers (haematological, ionic, respiratory, liver, inflammatory, metabolic). To assess their potential association with PCHI, the peak, trough and first 5-day average serum biomarker levels were collected for 71 PCHI cases (46 bilateral hearing loss [BHL], 25 unilateral hearing loss [UHL]). Seventy-one controls were matched by sex, gestational age, birth weight, and time spent on the NICU < or > 48 hours.

Results: Statistically significant differences were identified for BHL cases versus controls of minimum platelet count, bilirubin (average, peak), peak conjugated bilirubin, peak alanine aminotransferase, albumin (average, minimum), pH, and peak creatinine levels (Mann-Whitney U,  $P < 0.05$ , Bonferroni-corrected). Alkaline phosphatase was the single significant biomarker for UHL.

As a predictor of degree of BHL, the only statistically significant biomarker, with moderate associations, were between peak conjugated bilirubin, minimum levels of albumin, and peak creatinine levels (Spearman Rank;  $P < 0.05$ ).

Conclusion: There are candidate biomarkers for PCHI in our cohort, predominately for BHL. Minimum albumin, peak creatinine, and peak conjugated bilirubin could be considered as prognostic biomarkers for BHL.

## DOES EARLY CONDUCTIVE HEARING LOSS IMPACT ON LONGER-TERM LISTENING ABILITY?

**Dr. Kelley Graydon**<sup>1</sup>, Professor Richard Dowell<sup>1</sup>, Professor Gary Rance<sup>1</sup>  
<sup>1</sup>1, Melbourne, Australia

**Background:** Otitis media is very common in young children and can lead to temporary hearing loss. These disruptions in hearing during early childhood may impact a child's ability to listen and process sounds over the long-term, even after their hearing returns to normal levels. This study aimed to investigate how children who had previous ear infections and associated hearing loss performed on tests of binaural processing (using both ears together) at school age.

**Methods:** The study included 118 children aged 6.0-13.3 years - 82 with a documented history of otitis media and hearing loss, and 36 controls without such a history. All had normal hearing at the time of assessment. The researchers used the Listening in Spatialized Noise (LiSN-S) test to measure the children's speech perception in noise.

**Results:** Children with a past history of ear infections and hearing loss performed significantly worse than controls on all test conditions that relied on binaural cues ( $p < 0.005$ ). However, there was no difference between groups on conditions without binaural cues. Furthermore, 18% of the children with a history of hearing loss showed severely impaired binaural processing ability.

**Conclusion:** Results suggest a link between early conductive hearing loss and binaural listening deficits that persist after hearing has returned to normal. Clinically, these findings highlight the need for earlier intervention when children present with conductive hearing loss with otitis media. Results also suggest that screening measures of functional listening ability in school-age children with a history of early childhood middle ear dysfunction are necessary.



## CORTICAL ACTIVATION PATTERNS TO SPEECH DIFFER BETWEEN OLDER ADULTS AND THE VERY ELDERLY

**Dr. (PhD) Yael Zaltz**<sup>1,2</sup>, Ms. Yarden Aronson<sup>1</sup>

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**Background:** Individuals aged 80+ are the fastest-growing demographic and often struggle with speech comprehension, particularly in noise, which can lead to social isolation, depression, and cognitive decline. However, most studies examining speech perception in later life have focused broadly on those over 65. This study compares neural mechanisms in speech perception between older adults and the very elderly.

**Methods:** A total of 230 older adults were interviewed, with 62 meeting the inclusion criteria of independent living, good health, no noise exposure, and no known hearing deficits. These participants completed two 90–120-minute sessions, involving functional Near InfraRed Spectroscopy data collection, speech-in-noise (SIN) recognition thresholds, and various auditory, cognitive, and language tests. After excluding participants with poor hearing for their age or those who did not complete both sessions, data from 33 participants aged 65-77 years and 21 participants aged 80-91 years were analyzed.

**Results:** The older cohort exhibited poorer SIN perception, along with inferior hearing thresholds, auditory spectral resolution, and attention and inhibitory skills. Both age groups showed similar cortical activation patterns to speech across several temporal and prefrontal regions. However, only the very elderly activated the left temporopolar region, likely engaging linguistic processing to recognize words through top-down mechanisms. In contrast, the younger cohort activated the left dorsolateral prefrontal cortex, associated with attention and inhibitory control, still somewhat preserved in this relatively younger group.

**Conclusion:** These findings suggest that distinct neural compensatory mechanisms may help mitigate the age-related effects on speech perception across different age groups within the older population.

# AN UNCOMMON PRESENTATION OF BILATERAL SUPERIOR SEMICIRCULAR CANAL DEHISCENCE IN DANDY WALKER SYNDROME

**Research Assistant Yagmur Unal**<sup>1</sup>, Lecturer Sevgi Kadihanoglu<sup>2</sup>, ASSOCIATE PROFESSOR Betul Cicek Cinar<sup>3</sup>

<sup>1</sup>Department of Audiology, Istanbul Medeniyet University, ISTANBUL, Türkiye, <sup>2</sup>Department of Audiometry, Kutahya Health Sciences University, KUTAHYA, Türkiye, <sup>3</sup>Department of Audiology, Hacettepe University, ANKARA, Türkiye

**Background:** Dandy-Walker syndrome (DWS) is a rare congenital posterior fossa malformation, reported in only 1 in 25 000 to 30 000 live births, which occurs during the embryonic development of the cerebellum and fourth ventricle. DWS has multiple neurodevelopmental complications because the cerebellum, which is the mainly affected structure, is the region of the brain that regulates movement coordination as well as, partially, cognition and behavior. Auditory deficit is one of these complications. Here we present the case of patient diagnosed with Dandy-Walker Syndrome who have hearing loss

**Methods:** A thorough audiological assessment was performed in order to determine hearing loss. Additionally, the patient was also evaluated radiologically.

**Results:** According to the audiological evaluation, asymmetric hearing loss was observed in the patient and further examination was requested. MRI results showed agenesis of the inferior vermis, an expansion in the posterior fossa favoring Dandy-Walker deformity, and an extra-axial cystic enlargement linked with the fourth ventricle. The CT examination showed a bilateral SSCD.

**Conclusion:** When we look at the literature, only one case has been reported with both Dandy-Walker Syndrome and superior semicircular canal dehiscence. This finding obtained in this case emphasizes the importance of detailed audiological and radiological evaluation and is quite significant in terms of its contribution to the literature.

## SLC26A4 VARIANTS AND CEVA HAPLOTYPE IN SLOVAK COHORT WITH ENLARGED VESTIBULAR AQUEDUCT

**Lukas Varga**<sup>1,2</sup>, Silvia Borecka<sup>2</sup>, Marek Sklenar<sup>2</sup>, Diana Ugorova<sup>1</sup>, Dimitrios Paouris<sup>1</sup>, Samuel Svajka<sup>1</sup>, Daniela Gasperikova<sup>2</sup>

<sup>1</sup>Comenius University, Faculty of Medicine and University Hospital Bratislava, Department of ORL HNS, Bratislava, Slovakia, <sup>2</sup>Slovak Academy of Sciences, Biomedical Research Center, Bratislava, Slovakia

**Background:** Pathogenic variants in the SLC26A4 gene are associated with autosomal recessive non-syndromic hearing loss with inner ear malformations (NSEVA), namely enlarged vestibular aqueduct (EVA) or Mondini malformation, or with a syndromic hearing loss with thyroid manifestation (Pendred syndrome).

**Methods:** We included 37 Slovak probands of Caucasian ethnicity with sensorineural or mixed hearing loss associated with EVA, without clinical manifestations of other distinct syndromic diseases selected from our DNA repository of sensorineural deafness. Whole-exome sequencing (WES) with subsequent bioinformatic analysis was used for DNA analysis of the SLC26A4 gene followed by Sanger sequencing to verify variants identified by WES. All 12 SNPs of the Caucasian EVA (CEVA) haplotype were genotyped by kompetitive allele specific polymerase chain reaction (KASP) assay.

**Results:** We established the genetic aetiology of NSEVA or Pendred syndrome in thirteen probands (35%). Ten probands carried biallelic SLC26A4 variants and three additional probands were identified to harbour only single mutant allele in combination with CEVA haplotype. Seven probands manifested with Pendred syndrome and six with NSEVA. In most cases the hearing loss was congenital or prelingual (10/13), progressive (9/13) and profound (10/13) at least in one ear. Four subjects reported association of hearing loss onset or sudden worsening of pre-existing hearing impairment with head trauma.

**Conclusion:** Our results show a correlation between the number of affected alleles and the resulting phenotype and support association of the CEVA haplotype with the NSEVA phenotype. Supported by research grants APVV-20-0236 and VEGA 1/0572/21.

## Poster Pitch Session 2

Poster Area (Garderober 1), May 15, 2025, 15:00 – 15:30

### THE FIRST RESULTS OF THE UNIVERSAL AUDIOLOGICAL SCREENING FOR NEWBORNS IN THE REPUBLIC OF MOLDOVA

**PhD Anghelina Chiaburu<sup>1</sup>**, PhD Doina Chiaburu-Chiosa<sup>1</sup>, PhD Diana Chirtoca<sup>1</sup>

<sup>1</sup>University Of Medicine And Pharmacy,,N.Testemitanu,,, Chisinau, Moldova

**Background:** In 2024, with the support of the Ministry of Health, UNICEF, and the Government of Japan, the implementation of universal newborn hearing screening became possible.

**Objectives.** The implementation of universal newborn hearing screening aims to enable early diagnosis and prosthetic rehabilitation through hearing aids or cochlear implantation in children with hearing loss.

**Methods.** Audiological screening is conducted in three stages: Stage I: In maternity hospitals and perinatal centers, screening is performed using otoacoustic emissions (OAE). Stage II: In ENT clinics, screening includes an ENT status evaluation and repeat OAE. Stage III: At the Audiology Center for final examinations.

**Results.** Between 01/01/2024 and 31/12/2024 a total of 19,731 births were registered. Stage I screening was performed on 18,870 newborns (96.14%); 65 cases refused the test, 861 newborns (4.36%) did not pass Stage I screening due to various reasons. Stage II In ENT clinics, 22 newborns who missed Stage I screening and 260 newborns with "refer" results from Stage I were tested. Stage III At the Audiology Center, 696 newborns from Stages I and II underwent comprehensive audiological examinations. Hearing loss was confirmed in 21 newborns .

Final diagnoses were confirmed within 1 month of age for cases with congenital anomalies and within 4 months for sensorineural forms. Bilateral sensorineural hearing loss: 13 children (6 severe, 7 moderate), unilateral severe sensorineural hearing loss 2, bilateral mixed hearing loss 2 children, unilateral mixed 4.

**Conclusion.** The proposed two-stage screening model involving ENT specialists, ensures accessibility to early audiological services for the population of the Republic of Moldova.

## NORMATIVE VALUES FOR TEST OF CENTRAL AUDITORY PROCESING DISORDERS IN CHILDREN AGED FROM 6 to 12

**Prof. Piotr Henryk Skarzynski**<sup>1,2</sup>, Natalia Czajka<sup>1</sup>, Rita Zdanowicz<sup>1</sup>, Aleksandra Kolodziejak<sup>1</sup>, Ewelina Bukato<sup>1</sup>, Malgorzata Talarek<sup>1</sup>, Zuzanna Pankowska<sup>1</sup>, Henryk Skarzynski<sup>3</sup>

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**Background:** Central auditory processing disorders (CAPD) can significantly affect the daily functioning of a child, and the first step in determining whether rehabilitation procedures are required is a proper diagnosis. Different guidelines for making diagnoses have been published in the literature, and in various centers normative values for psychoacoustic tests of CAPD have been used internally. The aim of this study is to present normative values for tests assessing CAPD in children aged 6 to 12 years, divided by age at last birthday.

**Methods:** We tested 1037 children aged 6 to 12 years who were attending primary schools and kindergartens. The criteria for inclusion were a normal audiogram, intellectually normal, no developmental problems, and no difficulties in auditory processing. To evaluate auditory processing all children were given three tests: the FPT, DPT, and DDT.

**Results:** The results from 1,037 children allowed us to determine normative values for FPT, DPT, and DDT in seven different age groups. We developed a new approach, based on quantile-based norms, to determine normative values in each group. Three categories - average, below-average, and above-average - allow for a broader but more realistic interpretation than those used previously.

**Conclusion:** Our study is the largest normative database published to date for CAPD testing, setting a standard for each child by age in years. We used the Senses Examination Platform, a universal tool, to unify standards for the classification of CAPD. Our study can serve as a basis for the development of a Polish model for the diagnosis of CAPD.

# AUDIOMETRIC CHARACTERISTICS OF PRESBYCUSIS AND NOISE-INDUCED HEARING LOSS: A SCOPING REVIEW

**Guilherme Lopes De Oliveira**<sup>1</sup>

<sup>1</sup>Universidade Federal De Sergipe, Lagarto, Brazil

**Background:** Age-related hearing loss (presbycusis) and noise-induced hearing loss (NIHL) are the primary causes of acquired hearing impairment, often presenting with overlapping audiometric characteristics. Differentiating between these two conditions is essential for accurate diagnosis and effective therapeutic interventions.

**Methods:** Following PRISMA-ScR guidelines, a scoping review was conducted using the PubMed and BVS databases, covering the period from 2019 to 2024. The search terms used for both databases were: ("Presbycusis" OR "Noise-Induced Hearing Loss") AND ("Audiometry, Pure-Tone" OR "Hearing Tests"). Studies published in English and Portuguese that investigated audiometric characteristics in adults and explored differences between presbycusis and NIHL were included.

**Results:** The review included 18 studies published between 2019 and 2024. The findings indicated that presbycusis presents a bilateral and symmetric audiometric pattern, with progressive high-frequency hearing loss directly associated with aging. In contrast, NIHL often manifests as hearing loss at frequencies between 3 and 6 kHz, which may be unilateral or asymmetric, particularly in individuals exposed to intense, prolonged noise. Advanced audiometric tests, such as otoacoustic emissions (OAE) and auditory brainstem responses (ABR), were useful in evaluating underlying mechanisms. Occupational factors, duration exposure were key determinants of NIHL, while metabolic and cardiovascular conditions were more commonly associated with presbycusis.

**Conclusion:** Specific audiometric differences, such as affected frequency patterns and symmetry of hearing loss, are critical for distinguishing presbycusis from NIHL. Complementary audiometric testing and consideration of associated risk factors contribute to more accurate differential diagnoses. These findings highlight the importance of preventive, therapeutic policies targeting aging populations and individuals exposed to noisy environments.

# DEVELOPMENT OF A SUPPORTIVE MOBILE APPLICATION FOR INDIVIDUALS AGED 18-40 WITH DIFFICULTIES IN CENTRAL AUDITORY PROCESSING AND SPEECH UNDERSTANDING IN NOISE

**Masters degree Sude Nur Ozturk**, Audiologist Azra Odacı, Audiologist İrem Narin Kara, Audiologist Ayşe Nur Keler, MSc Caner Yatmaz

<sup>1</sup>Institute of health sciences/Audiology, Istanbul, Türkiye

**Background:** Central Auditory Processing Disorder (CAPD) individuals struggle in environments with background noise, reverberation, and accelerated speech. Similarly, speech comprehension in noisy settings, affected by traffic, industrial noise, and other sounds, is challenging. These issues occur in both individuals with normal hearing and those with hearing loss. Due to the lack of comprehensive therapy and support solutions for such difficulties in our country, the study aimed to develop a low-cost, accessible mobile application to address these challenges.

**Methods:** Questionnaires were prepared for individuals with central auditory processing disorder and those with difficulty understanding speech in noisy environments. These helped identify the most problematic noise types and environments. Word recordings were made in a silent booth using Praat, and various noisy environments were simulated using Audacity and WavePad Audio Editor. These recordings were played to participants, allowing the identification of difficult words. Based on this, 25 phonetically balanced word lists for each syllable were created to assess specific difficulties.

**Results:** Intelligibility was higher in less complex noise types, such as vacuum cleaners, shopping malls, and classrooms. However, it decreased in more intense and complex noises, including airports, concerts, and wind. In environments like restaurants, where noise complexity was high, intelligibility significantly dropped as the syllable count decreased. In accelerated speech, intelligibility remained largely unaffected, with participants generally able to comprehend the words well.

**Conclusion:** This study recommended follow-up periods of 3, 6, and 12 months. Therapy programs were developed based on individual difficulties and presented to participants through a mobile application tool.

# HYPERBARIC OXYGEN THERAPY AS AN ADJUNCT TO GLUCOCORTICOSTEROIDS TREATMENT FOR SUDDEN SENSORINEURAL HEARING LOSS – RETROSPECTIVE STUDY

**Prof. Piotr Henryk Skarzynski**<sup>1,2</sup>, Aleksandra Kolodziejak<sup>1</sup>, Elżbieta Gos<sup>1</sup>, Magdalena B. Skarzynska<sup>2,3</sup>, Natalia Czajka<sup>1</sup>, Henryk Skarzynski<sup>4</sup>

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**Background:** A retrospective clinical study was conducted to test the impact of including hyperbaric oxygen therapy in the treatment of patients with sudden sensorineural hearing loss (SSNHL).

**Methods:** A total of 63 adult patients with SSNHL diagnosed between 2015 and 2023 were divided into two groups: 36 patients treated with intratympanic glucocorticoid and orally administered glucocorticoid who also underwent hyperbaric oxygen therapy and 27 patients treated with intratympanic glucocorticoid and prolonged orally administered glucocorticoid. An audiological evaluation was performed using pure-tone audiometry.

**Results:** Average hearing gain as measured by pure tone average was 12.5 dB HL (+/- 19.9 dB HL) in the patients treated with steroids combined with HBOT, and was 14.1 dB HL (+/- 17.9 dB) in the patients treated with steroids alone. Successful treatment (complete recovery or marked improvement) was observed in 27.8% of the patients in the first group and in 25.5% in the second group. There was no statistically significant difference between the groups.

**Conclusion:** Both groups of patients—those treated with glucocorticoids and those treated with glucocorticoids and HBOT—had similar hearing outcomes. A prospective, controlled, and randomized study would provide more reliable knowledge about the efficacy of HBOT in treating SSNHL.



# PREOPERATIVE USE OF OTOPLAN-SOFTWARE FOR BONEBRIDGE SURGERY IN DIFFICULT ANATOMICAL CONDITIONS

**Dr. Peter Mair**<sup>1</sup>, Dr Adrian Damian Piec<sup>1</sup>, Clin.Ass.Prof.PD Dr. Astrid Magele<sup>1</sup>, Bsc, MSc Philipp Schoerg<sup>1</sup>, Professor MD, PhD Georg Sprinzi<sup>1</sup>

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- Division of Otorhinolaryngology, University Hospital St. Pölten, Dunant-Platz 1, 3100, St. Pölten, Austria

**Background:** The WHO reports that 466 million people worldwide, including 34 million children, suffer from disabling hearing loss (HL). While the majority of patients with moderate to severe HL can benefit from hearing aids (HA), some either do not experience sufficient benefit or cannot wear them. In such cases, implantable hearing devices, such as active transcutaneous bone conduction implants, offer a valuable solution for adults and children with moderate to severe conductive (CHL) and mixed HL (MHL), as well as for those with single-sided deafness (SSD).

**Methods:** This case report includes three patients with a challenging mastoid cavity due to congenital middle ear abnormalities or multiple prior cholesteatoma surgeries, resulting in mixed unilateral hearing loss. Preoperative CT scans were analyzed using Otoplan 3.0 software to determine the optimal placement of the Bonebridge Implant (BCI 602) in the temporal bone. All patients underwent pure-tone audiometry before implantation and three months postoperatively.

**Results:** No intraoperative or postoperative complications occurred. Implantation significantly improved mean sound-field thresholds (by 35 dB) at three months postoperatively in all patients.

**Conclusions:** Otoplan 3.0 software is a valuable tool for determining the optimal placement of the Bonebridge Implant in anatomically challenging cases. Therefore, we recommend preoperative anatomy-based fitting in patients with multiple prior ear surgeries or congenital ear malformations.

## Free Paper Session 6 - Auditory Implants (Part 2)

Herrensaal, May 15, 2025, 15:35 - 17:05

COMPARISON OF THE DIGIT TRIPLET TEST (DTT) AND THE OLDENBURG SENTENCE TEST (OLSA) IN COCHLEAR IMPLANT (CI) PATIENTS REGARDING PROGRESS IN SPEECH UNDERSTANDING AND LISTENING EFFORT

**Dr. Astrid Klinge-Strahl**<sup>1</sup>, Prof. Nicola Strenzke<sup>1</sup>, Prof. Dirk Beutner<sup>1</sup>

<sup>1</sup>UMG Göttingen, Göttingen, Germany

During routine follow ups in CI patients the progress of speech understanding in noise is commonly measured with the OLSA matrix test, which for CI patients, however, is challenging, frustrating and subjectively requires a high level of listening effort. A recently developed speech test in noise is the digit triplet test (DTT). Advantages are that digits are highly familiar, easy to learn and the closed set response limits effects of top-down processes, making the DTT a perfect candidate for testing speech recognition in CI patients. In this study we aimed to 1) compare speech reception thresholds (SRTs) and their improvement over time between the DTT and the OLSA and 2) evaluate the listening effort. We measured the DTT and the OLSA in noise across three time points. To evaluate listening effort we implemented 1) a dual-task paradigm in which subjects had to perform the DTT/OLSA (primary task) while simultaneously quickly reacting to a light switch-on (secondary task) and 2) a questionnaire. The DTT shows a significantly better SRT than the OLSA. There is no significant improvement in the DTT threshold whereas subjects improved significantly in the OLSA from the first to the third visit. The listening effort measured with the dual-task paradigm resulted in no significant difference in the mean reaction times between the DTT and the OLSA. Reaction times increased with SNRs of increasing difficulty and they were higher for incorrect trials compared to correct trials. Subjectively, subjects rated the listening effort higher for the OLSA compared to the DTT in the questionnaire.

## THE CRITICAL PERIOD FOR SPEECH RECOGNITION DEVELOPMENT IN ADULT COCHLEAR IMPLANT RECIPIENTS

**Mei Jui Huang**<sup>1,2,3</sup>, William Kuan Hua Chen<sup>1,2</sup>, Yen Jung Pan<sup>2</sup>, Kuan Ju Chen<sup>1</sup>, Shu Yun Jheng<sup>1</sup>, Joshua Kuang Chao Chen<sup>1</sup>

<sup>1</sup>China Medical University Hospital / Holistic Hearing Healthcare Center, Taichung, Taiwan, <sup>2</sup>China Medical University Hospital Taipei Branch / ENT, Taipei, Taiwan, <sup>3</sup>National Kaohsiung Normal University / Department of Special Education, Kaohsiung, Taiwan

**Background:** In recent years, an increasing number of adults have visited our clinic seeking cochlear implant (CI) assessments. One of their most common concerns is how long it will take for their communication skills to improve. Therefore, the aim of this study was to investigate the critical period for improvement, along with the associated benefits and challenges within this timeframe.

**Methods:** This retrospective study collected data from 134 ears. All recipients had their CIs activated within 24 hours post-surgery. Follow-ups were conducted at 1 week (1W), 1 month (1M), 3 months (3M), 6 months (6M), and 1 year (1Y). Audiologists performed CI mapping, hearing tests, and patient-reported outcome assessments. Speech recognition tests included closed-set and open-set word lists, with patients scoring above 50% on the closed-set advancing to the open-set list.

**Results:** Recipients were divided into four groups based on SRS and test materials. In Group 1, SRS improved significantly from 1W to 1M post-surgery and then stabilized. Group 2 showed significant improvement from 1W to 1M and further from 1M to 3M, stabilizing afterward. No significant improvement was noted in the first three sessions for Group 3. In Group 4, SRS improved significantly between 1M and 3M and again from 6M to 1Y.

**Conclusion:** The findings indicate that the critical period for speech recognition development typically occurs within the first 3 months postoperatively. Emphasizing rehabilitation efforts during this period is crucial. These results provide valuable insights for setting realistic expectations for patients regarding the outcomes of cochlear implants.

## IMPROVED OUTCOMES WITH ANATOMY-BASED FITTING IN SINGLE-SIDED DEAF AND BILATERAL COCHLEAR IMPLANT USERS

**PD Dr. Anja Kurz**<sup>1</sup>, Prof. Dr. med. Stephan Hackenberg<sup>1</sup>, Dr. med. Franz-Tassilo Müller-Graff<sup>1</sup>, Prof. Dr. med. Kristen Rak<sup>1</sup>

<sup>1</sup>Comprehensive Hearing Center Würzburg, Würzburg, Germany

**Background:** Anatomy-based fitting is a new fitting method that allows personalization. The prerequisite is fitting software, in which patient-specific data can be imported from a planning platform for otological surgery. The audiologist can then set a frequency-band distribution that is more closely aligned to the tonotopic frequency distribution. The concept of anatomy based fitting has been evaluated during several studies. The aim was to 1) compare the benefit of a new fitting methodology with the established fitting methodology and 2) evaluate other influencing factors, e.g., insertion depth and electrode array

**Methods:** Participants were 20 experienced bilateral and single-sided deaf adult cochlear implant users. Speech perception in noise (in different spatial settings), pitch perception and patient-reported outcomes were assessed at two intervals. At study start, subjects used their routine clinical map (with standard frequency bands). Subjects were then fit with an anatomy-based fit map. After three months of use with this map, subjects repeated the tests.

**Results:** The results show that bilateral users with different electrode array lengths had better speech perception in quiet and in noise with the anatomy-based fitted map. In bilateral CI recipients, where the first electrode contact did not reach an angular insertion depth of 600- 720° degrees, anatomy based fitting was not accepted. An improvement of speech perception in quiet and noise could further be confirmed with the anatomy-based mapping in the group of SSD CI recipients.

**Conclusion:** Anatomy-based fitting should be considered as an alternative to the standard clinical fitting especially in dissatisfied cochlear implant users.

## FIRST RESULTS WITH A COCHLEAR IMPLANT FITTING METHOD USING POST-OPERATIVE ELECTRODE LOCATION DATA IN NEWLY IMPLANTED USERS

**Assoc. Prof. Priv. Doz. Dr. Dominik Riss**<sup>1</sup>, Freya Brauer<sup>1</sup>, Dr. Thomas Thurner<sup>1</sup>, Dr. Alice Auinger<sup>1</sup>, Dr. Christoph Arnoldner<sup>1</sup>

<sup>1</sup>Universitätsklinik für Hals-, Nasen- und Ohrenkrankheiten, Medizinische Universität Wien, Vienna, Austria

**Background:** Post-operative imaging allows to determine the actual cochlear implant (CI) electrode contact locations with respect to tonotopy. This can be used during CI fitting to adjust the frequency bands assigned to specific electrode contacts in order to minimize the frequency-to-place mismatch. The aim of this study is to investigate the effects of anatomy-based fitting on various CI performance and preference outcomes in new CI users. It is examined if the individualized settings can speed up the rehabilitation process with regard to speech understanding and related outcome measures.

**Methods:** Newly implanted CI patients are randomly fitted with a map utilizing either frequency band parameters based on post-operative electrode contact locations or standard filterbank settings. Word recognition for numbers and monosyllables are followed up until six months post activation. A phoneme recognition task as well as a consonance-dissonance rating task for musical intervals is performed after two weeks, 3 months and six months. In addition, bimodal and SSD patients perform a frequency ranking experiment and a subjective pitch and timbre comparison task to assess potential benefits of individualized frequency bands for binaural integration. Spatial release from masking is measured using a German matrix sentence test in different loudspeaker configurations in both groups with contralateral acoustic hearing.

**Results:** Preliminary data will be presented. Most notably, analysis shows a trend towards better sensitivity to unilateral spectral cues in phoneme recognition when using anatomy-based fitting.

**Conclusion:** CI fitting with frequency mapping based on post-operative electrode location could become a meaningful alternative to fitting without frequency band individualization.

## THE EFFECTS OF TEMPORAL MISALIGNMENT ON SPEECH RECOGNITION WITH BIMODAL AND EAS HEARING A SIMULATION STUDY

**Qi Gao**<sup>1,2</sup>, Professor Lena Wong<sup>1</sup>, Professor Fei Chen<sup>2</sup>

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**Background:** Temporal misalignment between signals exists when listeners utilize a hearing aid and a cochlear implant simultaneously. This study aimed to investigate the effects of within- and across-ear temporal misalignment between acoustic and simulated electric signals on speech-in-noise recognition.

**Methods:** Sentence recognition scores were measured in speech-spectrum noise (SSN) and amplitude modulated noise (AMN) from two groups of normal-hearing listeners. Signals were processed by a low-pass filter and an 8-channel noise vocoder, presented dichotically to simulate bimodal hearing and combined monaurally to simulate EAS hearing. Temporal misalignment was implemented by introducing delays between simulated electric and acoustic signals at 0,  $\pm 5$ ,  $\pm 10$ ,  $\pm 15$ ,  $\pm 30$  ms, with positive delays (Group one) simulating the electric signal leading and vice versa (Group two).

**Results:** Results showed that speech recognition scores significantly decreased with increasing delays. The negative impact of temporal misalignment was significantly greater when the simulated electric signal lagged the acoustic signal. Although no significant interaction was found between delay and listening conditions and background noise, there was a trend of greater negative impact of temporal misalignment with EAS hearing in AMN.

**Conclusion:** Despite the reduction in speech recognition scores at delays within  $\pm 15$  ms did not reach a significant level, it is still recommended to compensate for temporal misalignment between acoustic and electric signals to potentially enhance speech recognition and achieve benefits in other aspects.

# LONG-TERM STABILITY OF RESIDUAL HEARING IN COCHLEAR IMPLANT USERS WITH ELECTRIC-ACOUSTIC STIMULATION

**M. Sc. Mariana Bandeira**<sup>1</sup>, Prof. Silke Helbig<sup>2</sup>, Prof. Timo Stöver<sup>2</sup>, Prof. Uwe Baumann<sup>1</sup>, Prof. Tobias Weißgerber<sup>1</sup>

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**Background:** The success of combined electrical-acoustic stimulation (EAS) depends on preserving low-frequency residual hearing and maintaining its long-term stability. This study evaluates the long-term stability of residual hearing in subjects with EAS and examines whether EAS can be effectively used in long term.

**Methods:** In 87 subjects (110 ears) fitted with EAS residual hearing was followed for up to 13 years (mean: 76 months, range: 16 months to 13 years). Low-frequency pure-tone average (LFPTA) at 125/250/500 Hz was obtained in the first year (3, 6, and 12 months after surgery) and at the last available follow-up visit. Additionally, it was analyzed whether the acoustic component of the EAS system remained active over the long term or if electric only mode had to be switched on.

**Results:** Preoperative median LFPTA was 33.3 dB HL, worsening significantly to 45 dB HL three months post-surgery. No further significant changes were observed between 3, 6, and 12 months. In the long-term, LFPTA increased significantly to 56.7 dB HL (range: 18.3 to 91.7 dB HL). 80.5% of ears retained functionally relevant acoustic hearing (LFPTA < 80 dB HL), and 81.6% of ears continued using the EAS device at the long-term.

**Conclusion:** Although residual hearing declined over time, most patients maintained long-term functionally relevant acoustic hearing and continued using the EAS device. Considering the advantages of EAS over electrical stimulation, cochlear implantation with hearing preservation should be conducted whenever possible.

# APPLICATION OF THE BONE CONDUCTION HEARING IMPLANT IN A PATIENT WITH TREACHER COLLINS SYNDROME

Natalia Radecka<sup>1</sup>, PhD Katarzyna Beata Cywka<sup>1</sup>, **Prof. Piotr Skarzynski**<sup>1</sup>

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<sup>2</sup>Institute of Sensory Organs, Kajetany, Poland

**Background:** Treacher Collins syndrome can be genetic or occur spontaneously. Symptoms of the disease cover the craniofacial area, including the ears. Changes and deformities, mainly in the outer and middle ear, can lead to hearing loss. There are many possibilities for malformation, and hearing thresholds can range from normal hearing to profound hearing loss. Patients usually present with audiological results characteristic of conductive or mixed hearing loss, which results in problems with understanding speech. Bone conduction hearing implants are the most beneficial treatment for this condition when conventional hearing aids are ineffective or cannot be used. These include the Bonebridge system for adults and children over 5 years of age with conductive or mixed hearing loss with a bone conduction threshold  $\leq 45$  dB HL.

**Case report:** A patient with Treacher Collins syndrome and progressive hearing loss since childhood used classic air conduction hearing aids, but did not obtain the expected hearing benefit from them. In addition, there was a lack of speech comprehension. A bone conduction implant Bonebridge was used, due to chronic otorrhea.

**Conclusions:** The results showed a significant improvement in hearing and speech understanding after using the Bonebridge system. Many previous studies show similar effects of implantation.



# COCHLEAR IMPLANTATION IN ADULTS WITH AUDITORY NEUROPATHY SPECTRUM DISORDER: AUDITORY OUTCOMES AND PROGNOSIS FACTORS

**Isabelle Mosnier**<sup>1</sup>, Laurie Verbanck, Ghizlene Lahlou, Hannah Daoudi

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**Background:** Most studies on cochlear implantation (CI) in patients with auditory neuropathy spectrum disorder (ANSD) focused on paediatric populations, and reported improvements in speech intelligibility and language acquisition in 50 to 94% of cases; In contrast, research on adults is sparse. The objective of this retrospective study was to evaluate the auditory outcomes and prognostic factors of CI in adult patients diagnosed with ANSD.

**Methods.** Twenty-five adults with confirmed ANSD, who underwent CI were included. Audiological outcomes were measured before and 3, 6, 12, and 24 months after CI in quiet and noise, and patients were arbitrarily divided into good (>50% speech scores at 1-year in quiet) and poor performers. Pre- and post-implantation data were analyzed to identify prognostic factors for good performance.

**Results.** The mean age at CI was  $49 \pm 2.9$  years, with a follow-up of  $6 \pm 0.7$  years. At 1-year post-implantation, the mean speech intelligibility in quiet improved significantly by  $40 \pm 6.3\%$  from preoperative baseline. For the good performers ( $n=13$ ), speech intelligibility in quiet and in noise increased as early as 3 months post-implantation to reach  $78 \pm 3.9\%$  in quiet and  $75 \pm 7.1\%$  in noise at 1-year post-implantation. In contrast, poor performers did not improve their scores. Patients with post-synaptic ANSD seemed to have poorer outcomes, although it did not reach significance.

**Conclusion.** Despite the challenges, CI remains a viable option for adult patients with ANSD, with nearly half of the population demonstrating improvements in speech intelligibility, in quiet and in noise. However, the patient must be informed that the result is not guaranteed.

## Free Paper Session 7 - Screening & Diagnostics (Part 1)

Prälatensaal, May 15, 2025, 15:35 – 17:05

### HEARING LOSS IN SYSTEMIC SMALL-VESSEL VASCULITIS: AUDIOLOGICAL ASPECTS ACROSS DISEASE TYPES

**Ph.D. Vija Vainutienė**<sup>1</sup>, Prof. Ph.D. Eugenijus Lesinskas<sup>1,2</sup>, Ph.D. Tatjana Ivaškienė<sup>3</sup>, Assoc. Prof. Ph.D. Justinas Ivaška<sup>1,2</sup>

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**Background:** Systemic small-vessel vasculitis (SV) comprises a group of rare autoimmune diseases with diverse etiologies and clinical presentations. Audiovestibular dysfunction in SV may manifest with variable symptoms. This study aimed to assess auditory function and speech perception in patients with SV and examine the relationship with disease-specific parameters.

**Methods:** Forty patients with SV (mean age: 48.9 years, range: 28–65 years) underwent audiological evaluation, including otoscopy, impedance audiometry, pure-tone audiometry, and speech audiometry. Data were analyzed using R software (version 4.3.1), with continuous variables expressed as medians, quartiles, and means (standard deviations). A p-value < 0.05 was considered statistically significant.

**Results:** Among participants, 52.5% had granulomatosis with polyangiitis (GPA), 27.5% eosinophilic granulomatosis with polyangiitis (EGPA), 12.5% necrotizing vasculopathy (NV), and 7.5% microscopic polyangiitis (MPA). The mean disease duration was 4.14 years. Auditory complaints were reported by 77.5% of patients, with otological symptoms as the initial presentation in 20%. Pure-tone audiometry identified hearing loss in 50% of patients, predominantly sensorineural (33.8%), followed by mixed (13.7%) and conductive (2.5%) types. NV patients exhibited the highest prevalence of hearing impairment (60%), with sensorineural loss in 50%. Hearing loss was more frequent in ANCA-positive (53.7%) compared to ANCA-negative (42.3%) patients, predominantly of sensorineural type.

**Conclusions:** Hearing impairment, primarily sensorineural, was detected in 50% of SV patients and occurred more frequently in ANCA-positive individuals. Disease duration and medication did not significantly affect audiological outcomes. Routine audiological assessments are essential for SV management.

## AUTOMATIC DEVELOPMENT OF DIGITS-IN-NOISE TESTS: THE SLOVENIAN DIN AS AN EXAMPLE

**Prof. Cas Smits**<sup>1</sup>, MD Lea Zupan<sup>2</sup>

<sup>1</sup>Amsterdam UMC/dept. Otolaryngology, Amsterdam, The Netherlands, <sup>2</sup>General Hospital/ENT department, Celje, Slovenia

**Background:** Previously we have shown that it is possible to develop digits-in-noise (DIN) tests automatically using Text-to-Speech (TTS) and an Automatic Speech Recognition (ASR) system to replace human involvement without compromising DIN test quality. In the present study this AI-driven approach, named "Aladdin" (Automatic LAnguage-independent Development of the Digits-In-Noise test), was used to develop a DIN test in the Slovenian language.

**Methods:** We followed the Aladdin procedure which previously successfully created Dutch and English DIN tests. First, an TTS system was used to generate synthetic Slovenian digits from zero to nine. Second, speech noise was created from the digits and an ASR system (FADE) was used to perceptually equalize the digits. Third, a list of 120 unique digit triplets was created from the digits and an online adaptive DIN test was developed. Fourth, 25 normal hearing listeners performed diotic and antiphase DIN tests in Slovenia.

**Results:** The results will be discussed during the presentation. We will focus on test-retest reliability of the new DIN test.

**Conclusion:** Development of the DIN test in multiple languages can be markedly accelerated by leveraging synthetic speech and employing an appropriate ASR system. The Aladdin-test procedure has the potential for efficient and language-independent DIN test development for different languages.

# PARENTAL PERSPECTIVES ON A TELEAUDIOLOGY PROGRAM FOR DIAGNOSTIC NEWBORN AUDIOLOGY ASSESSMENTS INVOLVING STUDENT FACILITATORS

**Jocelyn Phillips**<sup>1</sup>, Professor Julia Sarant<sup>1</sup>, Professor Dani Tomlin<sup>1</sup>, Dr. Kelley Graydon<sup>1</sup>

<sup>1</sup>The University Of Melbourne, Melbourne, Australia

**Background:** Teleaudiology can improve access to audiology assessments, particularly in underserved areas. The need for in-person facilitators for newborn diagnostic audiology differentiates this service from many existing teleaudiology programs. This study aimed to explore parental perspectives on a teleaudiology program for newborn hearing screening that utilized student facilitators providing in-person support.

**Methods:** Eight infants and their families participated in diagnostic audiology appointments. Four appointments were conducted with the audiologist remotely, with final year audiology students acting as facilitators to provide in-person support. The remaining four families were seen via traditional face-to-face appointments. Following each appointment, semi-structured interviews were conducted with caregivers. Interviews explored their experiences, perceptions, and opinions regarding their appointments and opinions of a program involving student facilitators.

**Results:** Five main themes emerged from the caregiver interviews: 1) varying family perceptions of facilitator involvement and its impact on the teleaudiology experience, 2) the importance of ensuring student facilitator competency through comprehensive training and audiologist guidance, 3) effective communication and rapport-building via telehealth, with some concerns for supporting challenging scenarios, 4) improved convenience and accessibility of appointments with a newborn using telehealth, and 5) families' level of concern would influence family decisions to utilize teleaudiology.

**Conclusion:** The findings of this study highlight the importance of comprehensive training and audiologist guidance for student facilitators to address parental concerns.

# HEALTHY HEARING FOR HEALTHY AGING (HEAR-UAE): A MODEL FOR EARLY DETECTION AND INTERVENTION IN AGING POPULATION

**Dr. Muhammed Ayas**<sup>1</sup>

<sup>1</sup>University of Sharjah, Sharjah, United Arab Emirates

**Background:** Age-related hearing loss (ARHL) is a growing public health concern, contributing to cognitive decline, social isolation, and reduced quality of life. While European countries have integrated hearing health into aging policies, the UAE is still in the early stages of developing community-based screening initiatives for adults. Addressing low awareness, limited access to hearing healthcare, and stigma surrounding cochlear implants (CI) is crucial. This study explores key challenges and innovative strategies to improve hearing health outcomes.

**Methods:** The HEAR-UAE initiative was launched to promote early detection and intervention for ARHL. The program targets adults over 50 years in community health centers and old age homes, utilizing hearing and cognitive screening measures. It encourages the early adoption of CI to mitigate cognitive risks and explores AI-driven screening tools for scalable, long-term implementation.

**Results:** Preliminary findings suggest that integrating hearing screenings into primary care significantly enhances early detection and intervention rates. AI-driven tools improve accessibility and outreach in ARHL mapping. The study highlights the role of CI in addressing severe ARHL, emphasizing the need for greater access to advanced hearing solutions. These findings reinforce the feasibility of community-based approach to hearing healthcare in aging populations.

**Conclusions:** Routine hearing screenings, policy integration, and public awareness campaigns are crucial for promoting healthy hearing for healthy aging. The HEAR-UAE model demonstrates the feasibility of embedding hearing healthcare within primary care and community settings. This approach enhances early detection, facilitates timely interventions with CI, and improves the overall quality of life for older adults.

## COMMUNITY HEARING SCREENING PROGRAM

**Mg. Jorge Burdiles-Aguirre**<sup>1</sup>, Richard Hernandez-Romero<sup>1</sup>

<sup>1</sup>Universidad del Bío-Bío, Facultad de Ciencias de la Salud y los Alimentos, Departamento de Ciencias de la Rehabilitación en Salud., Chillán, Chile

**Background:** Hearing loss affects over 5% of the global population and it determines significant social and economic costs. Diagnostic audiometric evaluation is the gold standard for diagnosing hearing loss; however, screening assessments using portable devices save both time and costs. In Chile, hearing loss detection is regulated through two programs that do not provide universal coverage across all age groups. Thus, implementing additional actions focused on identifying hearing loss can strengthen existing methods.

**Methods:** A descriptive study was conducted analyzing the data from a hearing screening program at a Public University in Chile. The program included otoscopy, screening assessment audiometry, and referrals when necessary.

**Results:** A total of 212 participants were evaluated: 50.94% were people under 18 years old, and 49.06% were adults. Otoscopy revealed normal findings in 84.91%, while 15.09% showed abnormalities. Bilateral normal hearing was identified in 69.79% of participants, while 30.21% exhibited hearing impairment in one or both ears. Referral was unnecessary for 65.57%, and 34.43% required further evaluation.

**Conclusion:** The hearing screening program proved to be an effective strategy for detecting auditory issues and facilitating timely referrals, optimizing resources, and reaching diverse communities. These findings underscore the importance of implementing community-based interventions as a complement to traditional diagnostic methods for strengthening auditory healthcare.

## ASSESSMENT OF SPEECH SOUND PERCEPTION WITH A NONSENSE SYLLABLE TEST, BEFORE AND AFTER PHONETICALLY BASED THERAPY, IN USERS OF COCHLEAR IMPLANTS AND HEARING AIDS.

**Phd Arne Kirkhorn Rødvik**<sup>1</sup>, MEd Ingebjørg Skaug<sup>2</sup>, Professor Juha Tapio Silvola<sup>3,4</sup>, Professor Ona Bø Wie<sup>5</sup>, PhD Marte Myhrum<sup>4</sup>

<sup>1</sup>Oslo University Hospital, Oslo, Norway, <sup>2</sup>Cochletten, Oslo, Norway, <sup>3</sup>Akershus university hospital/ENT department, Lørenskog, Norway, <sup>4</sup>University of Oslo/Faculty of medicine, Oslo, Norway, <sup>5</sup>University of Oslo/Department of special needs education, Oslo, Norway

**Background:** A nonsense-word repetition test leaves no room for guessing word meaning, and therefore provides a concrete and precise assessment of factual speech sound perception. The authors seek to establish a habilitation protocol that would make more hearing aid (HA) and cochlear implant (CI) users reach their auditory perception potential.

**Methods:** 10 newly switched-on CI users and 8 newly fitted bilateral HA users were offered auditory training that also included repeated discrimination tasks using simple syllables in minimal pairs and triplets like [ba:]/[pa:]. Pre- and post-tests with nonsense word repetition units in random order were performed. The test was initially validated by a normal-hearing control group of 10, who all scored 100%, and by a group of six HA users, who were not offered auditory training.

**Results:** The score of the CI users improved from 32.3% (SD = 17.2) to 52,7% (SD = 14.1). Only two HA-users completed the auditory training program; one improved the test score and one had lower test score after training. The six remaining HA users quit the training program after only one session, because they felt no need for therapy.

**Conclusion:** The CI users benefited from a habilitation protocol that features pre- and post-testing with nonsense syllables and phonetically based auditory training on individual perceptually difficult speech sounds in the first few months after switch-on. The HA users did not to feel the need for auditory training. Pre- and post-testing with a nonsense syllable test is a feasible way of measuring the factual improvement in discrimination ability.

# EVALUATION OF ONLINE-ADMINISTERED HEARING HANDICAP INVENTORY: EFFECTS OF ITEM ORDER AND RELATION TO AUDITORY WELLNESS CATEGORIES

**Stefanie Goicke**<sup>1,2</sup>, Larry E. Humes<sup>3</sup>, Professor Tobias Neher<sup>1,2</sup>, Christian Brandt<sup>1,2</sup>

<sup>1</sup>Department of Clinical Research, University of Southern Denmark, Odense, Denmark, <sup>2</sup>Technical Audiology Section, Research Unit for ORL – Head & Neck Surgery and Audiology, Odense University Hospital & University of Southern Denmark, Odense, Denmark, <sup>3</sup>Department of Speech, Language and Hearing Sciences, Indiana University, Bloomington, USA

**Background:** Self-reported hearing difficulties are often assessed using the Hearing Handicap Inventory (HHI). HHI scores have recently been used to measure auditory wellness. This study investigated whether item order affects HHI scores and whether a 10-item screener version (HHI-S) can be extracted validly from the full 25-item version.

**Methods:** Participants (n = 168) over 50 years of age and with a wide range of hearing abilities completed the Danish HHI online. Two different orders of the 25-item HHI were compared: (1) the conventional order and (2) an experimental order in which the items were presented in blocks beginning with the 10-item HHI-S. HHI and HHI-S scores were compared for both item orders. Internal consistency and test-retest reliability were also examined. Auditory-wellness grades were determined, and the limits of agreement were calculated for each grade.

**Results:** No significant differences between different item orders were found for the HHI  $t[165] = .03$ ,  $p = .97$  or HHI-S ( $t[165] = -.16$ ,  $p = .87$ ). The HHI showed excellent internal consistency (Cronbach's  $\alpha = .95$ ; CI: .94 .96) and test-retest reliability (ICC = .89,  $p < .001$ ), as did the HHI-S ( $\alpha = .90$ ; CI: .88 .92; ICC = .86,  $p < .001$ ). The limits of agreement become broader as auditory wellness worsens.

**Conclusion:** The online HHI is a reliable tool for assessing self-reported hearing difficulties. The item order does not influence HHI outcome, and the 10-item HHI-S can be extracted validly from the 25-item version.



## Free Paper Session 8 - Screening & Diagnostics (Part 2)

Herrensaal, May 16, 2025, 09:00 - 10:30

### QUALITY CRITERIA IN NEWBORN HEARING SCREENING - FOUR IDENTICAL PROJECT APPROACHES - FOUR DIFFERENT OUTCOMES

**Peter Böttcher**<sup>1</sup>, Prof. W Adjibabi<sup>2</sup>, Prof. M. Keita<sup>3</sup>, Dr. Ch. Ndoleriire<sup>4</sup>, Dr. Rabindra<sup>5</sup>

<sup>1</sup>PATH MEDICAL, Germering, Germany, <sup>2</sup>Centre National Hospitalier Universitaire Hubert Koutoukou MAGA, Cotonou, Benin, <sup>3</sup>Centre Hospitalo-Universitaire Gabriel Touré, Bamako, Mali, <sup>4</sup>Makerere University, ENT Dept., Kampala, Uganda, <sup>5</sup>Tribhuvan University Teaching Hospital, Kathmandu, Nepal

**Background:** Results from four identically implemented neonatal hearing screening projects (referred to as A, B, C and D) are presented. All projects show different results. Even when standards such as the specificity of a test method are used, the results vary widely.

**Methods:** In all four projects, screening strategy, training courses, choice of methods, local conditions and the measuring devices used were identical. All projects also provided a tracking office with automated data transmission to a central server, complete with a tracking supervisor responsible for this data and ensuring continuous quality assurance measures. Each project was supervised and managed by external experts. Statistical results were compared and evaluated.

**Results:** Despite comparable conditions, the outcome of the screening differs significantly. When considering the TEOAE measurements alone, a different test specificity was found for each of the projects. The collection rates, failed rates and the effort per baby show how differently the projects developed.

**Conclusion:** There must be other reasons why projects can develop so differently. Continuous monitoring of a screening program is therefore of crucial importance. "Soft skills" of program supervisors, ongoing quality control and constant feedback for motivation are very important factors to ensure the success.

**Keywords:** Newborn Hearing Screening, Quality Control

## 22 YEARS OF POLISH UNIVERSAL NEONATAL HEARING SCREENING PROGRAM

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**Background:** Polish Universal Neonatal Hearing Screening Program (PUNHSP) has been running for over 22 years. Throughout this time almost 8 million children have been examined. According to Central Statistics Office, central database of PUNHSP registered 96.0% of the population of newborns.

**Methods:** All data is collected in the program using computer terminals across 466 centers throughout Poland.

**Results:** Currently, the central database includes 7,788,213 children born in Poland. Among these, 7,643,947 children (98.15%) underwent neonatal hearing screening. Of the screened children, 7,103,302 (92.93%) had a "Pass" result without any identified risk factors during pregnancy or the neonatal period, while 269,520 children (3.53%) had a "Pass" result but presented with risk factors. Additionally, 236,589 children (3.09%) had a "Reffer" result without risk factors, and 34,536 children (0.45%) had a "Reffer" result with risk factors identified during pregnancy or the neonatal period. A total of 144,266 children (1.85%) did not undergo hearing screening. This data highlights the comprehensive coverage of the screening program and the distribution of results based on identified risk factors.

An analysis of children who undergo audiological diagnosis revealed the following outcomes for a total of 435,840 children. Normal hearing was identified in 417,713 children (95.84%), while 18,127 children (4.16%) were diagnosed with hearing loss. These findings provide a detailed overview of the prevalence and classification of hearing impairments, offering valuable insights into the studied population.

**Conclusion:**

The Polish Hearing Screening Program has a consistently functioning system, enabling continuous monitoring and development of the program.

# REINFORCED CATEGORICAL LOUDNESS SCALING (rCLS) – AN EFFICIENT PROCEDURE FOR SELF-ADMINISTERED SIMULTANEOUS ASSESSEMENT OF HEARING THRESHOLDS AND LOUDNESS PERCEPTION

Chen Xu<sup>1</sup>, Dr. Lena Schell-Majoor<sup>1</sup>, **Prof. Dr. Dr. Birger Kollmeier**<sup>1</sup>

<sup>1</sup>Medizinische Physik & Cluster of Excellence Hearing4all, Universität Oldenburg, Oldenburg, Germany

**Background:** Self-administered audiological assessment has a great potential for supplementing clinical audiological diagnostics with data-driven applications, such as auditory profiling, which requires data on hearing thresholds and suprathreshold auditory perception [1]. In order to increase the efficiency, robustness and reliability of self-administered audiological procedures, the adaptive categorical loudness scaling procedure [2] was extended by presenting additional stimuli close to the estimated threshold.

**Methods:** This “reinforced” categorical loudness scaling procedure improves the accuracy of hearing thresholds derived from the loudness functions fitted to the data in comparison to the standard ACALOS procedure which puts less weight on stimuli close to the absolute threshold.

**Results:** Experimental data have shown increased correlation with pure-tone audiometry. In comparison to separately performing ACALOS with an audiogram estimation like GraBr, a robust procedure for self-administered audiometry presented in the corresponding contribution, rCLS employs the same psychophysical task for the patient for threshold and suprathreshold testing and yields robustness to response outliers due to a fitting procedure operating across the whole dynamic range. This contribution will present the method and results from a validation study.

**Conclusion:** We will highlight the benefits of this combined procedure and discuss its further potential for data-driven audiology,

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[2] Brand, T., & Hohmann, V. (2002). An adaptive procedure for categorical loudness scaling. *The Journal of the Acoustical Society of America*, 112(4), 1597-1604.

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# ANALYSIS OF RISK FACTORS IN UNIVERSAL NEONATAL HEARING SCREENING PROGRAM IN POLAND.

**Ph.D Piotr Dąbrowski**<sup>1</sup>

<sup>1</sup>Poznan University of Medical Science, Poznań, Poland

**Background:** The aim of this study was to analyze the risk factors (RFs) observed in children participating in the Universal Neonatal Hearing Screening Program in Poland. Understanding the prevalence and impact of RFs is crucial for improving early detection and intervention strategies.

**Methods:** Data was collected from 2003 to 2024, encompassing 304 056 newborns. Risk factors were identified and recorded during screening, which included otoacoustic emissions (OAE) testing. The analysis focused on the prevalence of individual and combined RFs, as well as OAE outcomes.

**Results:** The most common RFs were exposure to ototoxic medications (53.37%), prematurity (16.42%), a family history of hearing loss (16.40%), intensive care treatment (15.37%), TORCH infections (12.91%), Apgar scores below 4 in the first minute (12.29%), and low birth weight (11.99%). Among children with RFs, 71% had a single RF, 13% had two, and 7% had three. The mean number of RFs per child was  $1.6 \pm [SD]$ . Screenings were conducted when infants were 2–3 days old.

**Conclusion:** This study highlights the prevalence of key risk factors and their association with hearing outcomes in newborns. The findings underscore the importance of targeted screening for high-risk populations to ensure early identification and intervention for hearing impairments. The program's systematic approach allows for effective monitoring and supports the ongoing development of neonatal hearing screening practices.

## AGREEMENT BETWEEN CONVENTIONAL AUDIOMETRY AND THE MIMI HEARING TEST MOBILE APPLICATION IN NOISY AND QUIET ENVIRONMENTS

**Mg. Jorge Burdiles-Aguirre**<sup>1</sup>, Dr. Jaime Crisosto-Alarcón<sup>1</sup>, Gabriela Lastra-Cabello<sup>1</sup>, Damián Cerda-Cifuentes<sup>1</sup>, Yorka González-Leiva<sup>1</sup>, Jean Valladares-Acuña<sup>1</sup>, Mg. Sebastián Rivera<sup>2</sup>

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**Background:** Hearing loss affects over 5% of the global population and it determines significant social and economic costs. In this context, mobile applications have emerged as accessible tools for hearing screening and as complements to standard audiometric tests. This study aims to analyze the agreement between results from conventional audiometry (CA) and the Mimi Hearing Test Mobile Application (MimiApp) in environments with varying levels of ambient noise (AN).

**Methods:** A quantitative, cross-sectional study was conducted with 58 participants without hearing impairments. Evaluations included CA and tests with MimiApp under AN conditions of 0dBHL, 40dBHL, and 70dBHL white noise. Statistical analyses compared CA results with MimiApp outcomes under the three noise conditions, based on the interpretation of assessments (normal hearing/hearing loss) for the right and left ears. Simplified contingency tables were created for each comparison, followed by McNemar's test.

**Results:** No significant discrepancies were found between CA and MimiApp results under 0dB and 40dB AN conditions. However, significant discrepancies were observed under 70dB AN.

**Conclusion:** The findings support the potential of mobile applications as accessible and reliable tools for auditory evaluation in soundproof environments and under ambient noise levels of up to 40dB.

## AABR METHOD IN POLISH UNIVERSITY NEONATAL HEARING PROGRAM.

**Monika Zych**<sup>1</sup>

<sup>1</sup>Poznań University Od Medical Science, Poznan, Poland

**Background:** Automated Auditory Brainstem Response (AABR) is a key technique in many neonatal hearing screening programs in the world. At the end of 2024, the Polish University Neonatal Hearing Program was expanded to include the AABR method.

**Methods:** This method is performed on all infants who stay in the Neonatal Intensive Care Unit for more than 7 days, after the completion of otoacoustic emissions testing. By the end of 2024, over 350 children had undergone the testing. All children were referred to audiology centres for detailed diagnostics.

**Results:** The detailed results of the tests will be presented in May 2025, after a six-month period of implementing the AABR method.

**Conclusion:** Hearing screening programs based on both OAE and AABR methods enable early identification of hearing loss. The implementation of AABR in hearing screening programs is crucial in ensuring proper auditory care and early diagnosis of hearing disorders in newborns.

## ADVANCING COCHLEAR IMPLANTATION IN SERBIA: SCREENING AND DIAGNOSTIC CHALLENGES AND PROGRESS

**Assistant Professor Bojana Bukurov**<sup>1</sup>, Prof. Zoran Dudvarski<sup>1</sup>, Dr Konstatin Arsovic<sup>1</sup>, Prof. Nenad Arsovic<sup>1</sup>

<sup>1</sup>Faculty Of Medicine, University Of Belgrade, Clinic For Otorhinolaryngology, Belgrade, Serbia

**Background:** Cochlear implantation has transformed the landscape of auditory rehabilitation worldwide, yet in Serbia, several challenges persist. While the Cochlear Implantation program was established in the 2000s, a National Neonatal Hearing Screening Program is still not officially implemented, resulting in less than 50% of children being screened within their first year of life. Recent advancements were implemented in 2019, but COVID epidemics have eroded our previously well-established referral pathways. National screening and diagnostics protocols are urgently needed to identify and address hearing loss effectively.

**Methods:** The study analyzes current screening status and diagnostic protocols for cochlear implantation in Serbia, encompassing auditory, vestibular, and radiological assessments. Special focus is given to widening of the criteria for cochlear implantation with the inclusion of adults to highlight trends, outcomes, and areas for improvement.

**Results:** Including adult patients has expanded the scope of implantation, with outcomes demonstrating improved quality of life and auditory rehabilitation in over 100 patients. The implementation of vestibular testing has refined the patient's selection and enhanced preoperative assessments, allowing a more tailored approach. However, a lack of a universal screening program continues to delay early diagnosis and intervention in pediatric cases.

**Conclusion:** While Serbia has made strides in cochlear implantation, systemic gaps, such as the absence of a National Screening Program, impede early intervention for pediatric patients. Extending screening coverage and integrating advanced diagnostics in national strategy are critical steps in optimizing our auditory outcomes.

## Free Paper Session 9 - Auditory Implants (Part 3)

Prälatensaal, May 16, 2025, 09:00 - 10:30

### EFFECTS OF FREQUENCY COMPRESSION IN ACTIVE MIDDLE EAR IMPLANT USERS - A LONGITUDINAL CROSS-OVER INVESTIGATION

**Dr. Dominik Riss**<sup>1</sup>, Dr. Philipp Zelger<sup>2</sup>, DI Viktor Koci<sup>2</sup>, Dr. Faris Brkic<sup>1</sup>, Sonja Reiß<sup>1</sup>, Dr. Josef Seebacher<sup>2</sup>

<sup>1</sup>Universitätsklinik Für Hals-, Nasen- Und Ohrenkrankheiten, Medizinische Universität Wien, Vienna, Austria, <sup>2</sup>Universitätsklinikum Innsbruck, Klinik für Hör-, Stimm- und Sprachstörungen, Innsbruck, Austria

**Background:** Frequency compression (FCO) is a well-established feature in hearing aids. If conventional amplification of high-frequency sounds like consonants is not sufficient to make it audible to the hearing aid user it can be helpful to compress, i.e., to map this no longer audible frequency range into a lower audible range. Recently, FCO became available for active middle ear implant users. The aim of this investigation is to assess the effects of this feature in terms of hearing outcome subjective hearing performance.

**Methods:** Up to 10 active middle ear implant users with steeply sloping high-frequency sensorineural hearing loss (SNHL) are participating in a longitudinal cross-over study in a multi-center setting. Participants are using their implant with and without FCO for a period of three months, the order is determined by randomization. After each take-home period functional gain as well as speech perception performance is assessed. Further, participants complete the SSQ-C questionnaire at every visit to assess subjective hearing performance during the test period.

**Results:** Preliminary data indicate that the FCO setting is able to restore the perception of high frequency content and can improve speech perception in patients who fit the indication criteria of steeply sloping SNHL well.

**Conclusion:** Frequency compression could be a valuable option to enhance hearing performance in active middle ear implant users who otherwise might become non-users when the hearing system can no longer compensate for the degree of hearing loss in certain frequencies.



# SUBJECTIVE AND AUDIOLOGICAL BENEFIT OF A BONE CONDUCTION IMPLANT WITH THREE DIFFERENT FITTING STRATEGIES

**Dipl.-Ing. Univ. (TUM) Mst. Viktor Koci**<sup>1</sup>, Prof. Javier Gavilán<sup>2</sup>, MD Antonio della Volpe<sup>3</sup>, Professor PD Dr. Joachim Schmutzhard<sup>5</sup>, Professor MD, PhD Georg Sprinzl<sup>6</sup>, Prof. MD Simone Graf<sup>1</sup>, PD Dr. MBA Astrid Magele<sup>6</sup>, Elisabeth Zangerl<sup>1</sup>, Priv. Doz. Dr. Josef Seebacher<sup>1</sup>, MD Isabel Sanchez-Cuadrado<sup>2</sup>, PD Dr.med. Johannes Schnabl<sup>7</sup>, Phd Philipp Zelger<sup>1</sup>, PhD Luis Lassaletta<sup>4</sup>, PhD Miryam Calvino<sup>2,4</sup>  
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**Background:** The Bonebridge bone conduction implant by MED-EL is a well-established transcutaneous system for the treatment of conductive and mixed hearing loss, having been in use for over ten years. For the initial programming of the audio processor, a fitting formula is used, which can be pre-calculated based on the patient's audiogram or the vibrogram measured via the processor. Until now, the DSL/IO fitting formula and the NAL variants have been used. The new DSL-BC fitting formula is more precisely tailored to the stimulation method, and better "first fit" results are expected.

**Methods:** In the ongoing study, patients using the Bonebridge are assessed both audiotically and with a brief questionnaire. Three conditions are compared in a randomized manner: first, the setting the patient uses daily; second, the "old" pre-calculation using the DSL formula; and third, the "new" DSL-BC formula.

In the latter two cases, the vibrogram measured via the implant serves as the basis. In addition to standard audiological data, the aided thresholds, OLSA in quiet at 45 dB and 65 dB, and OLSA with adaptive speech level at a noise level of 65 dB (S0/N0) are measured.

**Results:** Preliminary results indicate that the new DSL-BC fitting formula delivers significantly better outcomes compared to the DSL formula. Data from our center so far show an additional improvement in the setting patients use daily.

**Conclusion:** In summary, the new DSL-BC fitting formula will likely provide a significant performance improvement for Bonebridge patients worldwide. This is especially relevant for regions with limited expertise in audiology.

## COCHLEAR IMPLANTATION: X-RAY GUIDED ANATOMY BASED FITTING

**Consultant Asma Alahmadi**<sup>1,2</sup>, Dr. Yassin Abdelsamad<sup>3</sup>, Ahmed Hafez<sup>3</sup>, Medhat Yousef<sup>1</sup>, Fida Almuhawwas<sup>1</sup>, Prof. Abdulrahman Hagr<sup>1</sup>

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**Objective:** Although anatomy-based fitting (ABF) shows good results, its use is limited due to the need for a CT scan. This study investigates the applicability of X-ray-guided ABF in minimizing frequency-to-place mismatch in cochlear implant (CI) users.

**Methods:** This prospective study was conducted at a specialized tertiary care center. Medical records of CI recipients with normal inner ear anatomy who underwent X-ray-based ABF between 2023 and 2024 were reviewed.

**Results:** Sixteen ears from 12 CI recipients (mean implantation age:  $17.0 \pm 16.7$  years) were analyzed. In the lower frequency range, ABF frequencies were closer to tonotopic frequencies (TF) than default frequency (DF) fitting, though basal electrode contacts showed higher deviations. In the center frequency range, ABF frequencies nearly matched TF, while DF and ABF were similar in the higher frequency range, indicating minimal mismatch. The mean calculated frequencies for each electrode contact using X-ray-guided ABF ranged from  $45.9 \pm 16.7$  Hz (C12) to  $574.3 \pm 49.5$  Hz (C1). The average absolute frequency-to-place mismatch was lower with ABF ( $2.6 \pm 3.8$  semitones) than with DF ( $6.6 \pm 5.6$  semitones). Correlation analysis showed a stronger association between Angular Insertion Depth (AID) and semitone shifts with ABF. The greatest DF-ABF discrepancies occurred at C3 and C4.

**Conclusion:** X-ray-guided ABF may improve CI users' frequency perception and speech recognition. However, further studies with larger groups and longer follow-up are needed to confirm its benefits.

## ACTIVE MIDDLE EAR IMPLANTS AND BONE CONDUCTION DEVICES - TOWARDS EVIDENCE-BASED INDICATION CRITERIA

**Prof. Dr. Hannes Maier**<sup>1,2</sup>, Dr rer. agr. Susan Busch<sup>1,2</sup>

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**Introduction:** In contrast to conventional hearing aids, where standardized methods to determine the maximum output (MO) exist, clinical methods for acoustic implants, such as bone conduction implants (BCI) and active middle ear implants (AMEI), are scarce. This is even more important as limitations in MO are crucial for speech intelligibility and thus, for the definition of evidence-based indication criteria. Recently, we demonstrated that individual frequency-specific MO of AMEIs can be determined from clinical routine data. A similar method applies to transcutaneous BCI that are inaccessible after implantation. This approach allows the determination of the dynamic range (DR) available to the patient in-situ and enables the analysis of how much coverage of the DR is required for sufficient speech intelligibility.

**Methods:** In patients implanted with the Vibrant Soundbridge (VSB) the MO and available DR were determined for different forward (N=212 ears) and different reverse (round window, N=69 ears) stimulation modes from routine patient data. In patients implanted with the BCI Bonebridge (N = 82 ears) either the ipsilateral in-situ average MO or the contralateral MO was determined.

**Results:** Word recognition scores (WRS) in quiet of VSB patients improved with increasing DR and were strongly correlated. The dependence of WRS on available DR with a steep performance increase at DR > 20 dB permits the definition of an evidence-based upper indication limit.

**Conclusion:** The individual, frequency specific MO and DR can be successfully determined in AMEIs and BCIs from patients' clinical data, permitting in-combination the definition of evidence-based, frequency-specific indication limits.

## EXPLORING THE POTENTIAL OF ELECTROMAGNETIC ACTUATORS FOR SOUND RECORDING

**Carolina Köstler**<sup>1</sup>, Mario Cebulla<sup>1</sup>, Kristen Rak<sup>1</sup>, Stefan Kaulitz<sup>1</sup>

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**Background:** The Floating Mass Transducer (FMT) is the electromagnetic actuator of the active middle ear implant Vibrant Soundbridge. Using the principle of induction, the movement of the actuator's magnet generates mechanical vibrations. Notably, this principle can also be applied in reverse, suggesting that the FMT could function as an implantable microphone capable of sound recording. This study investigates the intelligibility of speech recordings made using the FMT as a microphone.

**Methods:** In this study, FMTs specifically customized for the microphone application were used. The FMT was coupled to an artificial tympanic membrane within a simple model of the auditory canal. The model was placed in front of a loudspeaker. Lists of German speech test stimuli were presented at 65 and 80 dB SPL and recorded via the FMT.

**Results:** Speech test recordings made using the FMT were presented to normal-hearing subjects via a loudspeaker at sound pressure levels of 65 and 80 dB SPL. At both levels, the recordings were fully intelligible to all subjects.

**Conclusion:** Although the model does not correspond to natural human hearing, it facilitated effective speech recordings using the FMT. The results confirm the feasibility of using the FMT in reverse mode for sound recording and could be a fundamental component for the development of fully implantable cochlear implants. Future research will include speech intelligibility tests with cochlear implant users to further explore this innovative application.

## EFFECTIVENESS OF BONE CONDUCTION IMPLANTS IN PATIENTS WITH SINGLE-SIDED DEAFNESS (SSD)

**Prof. Piotr Skarzynski**<sup>1</sup>, PhD Katarzyna Beata Cywka<sup>1</sup>, Emilia Czaplicka<sup>1</sup>, Prof. Henryk Skarzynski<sup>1</sup>

<sup>1</sup>World Hearing Center, Institute Of Physiology And Pathology Of Hearing, Kajetany, Warsaw, Poland,

<sup>2</sup>Institute of Sensory Organs, Kajetany, Poland

**Background:** To evaluate the audiological and subjective benefit from hearing rehabilitation with an active bone conduction implant in patients with single-sided deafness (SSD).

This prospective study aimed to evaluate the safety and benefits of active transcutaneous bone conduction implants for patients with SSD.

**Methods:** The study included 40 participants aged 13 to 48 years (mean: 32.5 years) diagnosed with SSD. The leading cause of SSD was congenital deafness and mumps-related deafness. All patients were unsuitable for traditional CROS hearing aids or cochlear implants due to anatomical limitations or intolerance. **Interventions:** Each patient underwent surgical implantation of bone conduction device on the deaf side, transmitting sound to the properly hearing ear.

Speech recognition in noise was assessed using the Polish Sentence Matrix Test, while patient satisfaction and quality of life were evaluated pre- and post-implantation using the Abbreviated Profile of Hearing Aid Benefit (APHAB) questionnaire.

**Results:** Significant improvement in speech recognition in noisy environments was observed, with mean Matrix Test scores improving from +0.4 dB SNR at initial appointment to -3.9 dB SNR six months post-activation. The APHAB questionnaire revealed enhanced communication, with a mean benefit score of 20.5 points.

**Conclusions:** Bone conduction implants offer an effective and safe solution for SSD, improving speech understanding in noisy conditions and quality of life for patients.

The study was approved by Bioethics Committee of the Institute of Physiology and Pathology of Hearing (KB.IFPS/7/2020).

# IMPROVING HEARING PERFORMANCE IN MIDDLE EAR IMPLANT USERS: A COMPARISON OF THE SAMBA 2 AND PREVIOUS VIBRANT SOUNDBRIDGE AUDIO PROCESSORS

**Phd Anna Ratuszniak**<sup>1</sup>, Prof. Artur Lorens<sup>1</sup>, Ass. Prof. Anita Obrycka<sup>1</sup>, MSc Justyna Witkowska<sup>1</sup>, Prof. Henryk Skarżyński<sup>1</sup>, Prof. Piotr H. Skarżyński<sup>1,2</sup>

<sup>1</sup>World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany, Poland, <sup>2</sup>Institute of Sensory Organs, Kajetany, Poland

**Background:** The Vibrant Soundbridge (VSB) middle ear implant is a partially implantable solution that has been used in clinical practice for over 25 years. It consists of an internal part (implanted behind the ear) and an external part (audio processor). As technology advances, audio processors are constantly being improved to enhance communication, performance and hearing function for users. Samba 2 is the latest audio processor introduced for VSB.

The aim of this study is to compare the benefits of using the latest Samba 2 processor with previous generation processors in a group of experienced VSB users.

**Methods:** Twenty-two experienced VSB users (mean time using VSB = 9 years, SD = 2) had their processor upgraded to the latest model (Samba 2). The mean age of the subjects was 56 years (SD = 20). Assessment included free-field audiometry, speech tests in quiet and noise, and patient-reported outcome measures (PROMs). In addition, the group of users who underwent subjective assessment using PROMs was expanded to 45 users.

**Results:** Free-field audiometry showed statistically significant improvements in hearing sensitivity and speech discrimination in quiet and noise with the Samba 2 compared to the previous technology. PROMs confirmed the benefits of using the latest audio processor and there was greater satisfaction with its ease of use.

**Conclusion:** The results of the tests performed and the evaluation of the questionnaires indicate that the use of the new audio processor improves the audiological results and the functioning of the users. Access to modern technology for VSB patients provides measurable benefits.

## CONSEQUENCES OF MICROPHONE DEFECTS IN CI LISTENERS

**Dr. Tim Liebscher**<sup>1</sup>, Dr. Cynthia Glaubitz<sup>1</sup>, Dr. Anne Hast<sup>1</sup>, Prof. Ulrich Hoppe<sup>1</sup>

<sup>1</sup>Hals-Nasen-Ohren-klinik – Kopf- Und Halschirurgie Universitätsklinikum Erlangen, Erlangen, Germany

**Background:** The technical inspection of internal and external components is an integral part of cochlear implant (CI) aftercare. The speech processor (SP) is routinely checked to ensure functional microphones. However, only a few SPs offer an objective microphone check.

CI systems also record the duration of use of the SP and exposure to certain listening environments via data logging. In a bilateral CI fitting, a large deviation between left and right SP in the detected hearing environment could indicate a faulty microphone. The aim of this study is to compare the datalog entries of bilateral CI users in order to identify potential microphone defects.

**Methods:** The retrospective data analysis includes 314 bilateral CI users who received a Cochlear Nucleus 6 system or higher. The individual data log entries were analyzed with regard to the duration of CI use. Additionally, the various listening scenes were analyzed and compared by side. With a comparable CI-use, deviations > 15% between the listening scenes of the left and right SP were considered conspicuous.

**Results:** Of the 628 SP examined, nine SP were assessed as conspicuous. Significant differences of up to 54% were detected between the two devices in the “quiet” listening environment. In one case one of the SPs could only detect the scene “quiet” (100%).

**Conclusion:** The information from the data logs enables the identification of microphone defects. It is recommended to use the datalog information as part of the technical check in the clinical routine.

## Poster Pitch Session 3

Poster Area (Garderobe 1), May 16, 2025, 10:35 - 11:05

### DIAGNOSING AUDITORY PROCESSING DISORDER IN ADULTS – A SCOPING REVIEW OF DIAGNOSTIC GAPS

**Mphil Cathrine Redi**<sup>1</sup>

<sup>1</sup>Østfold University College, Halden, Norway

**Background:** Auditory Processing Disorder (APD) is a condition in which sound processing is impaired in the brain. It affects several aspects of auditory perception and makes verbal communication more challenging. APD is often attributed to impaired neural auditory processing. It can be distinguished from peripheral hearing loss in that patients do not show deficits in the peripheral auditory system. Although often overlooked, APD is a common cognitive auditory disorder and can affect individuals of all ages. The prevalence of APD varies depending on the criteria used for diagnosis and the population being studied. We therefore aim to investigate the status of diagnostic practices for adults with APD and identify gaps in clinical practice and research.

**Methods:** Following PRISMA guidelines, we conducted a scoping review to identify and examine relevant literature on APD in adults. Searches across databases provided peer-reviewed articles which were then assessed to evaluate diagnostic tools (and protocols), accessibility and effectiveness of assessments.

**Results:** Findings indicate significant gaps in standardized diagnostic criteria and tools tailored for adults with APD. Most existing diagnostic tools are primarily designed for children leading to an age-related imbalance in diagnostic methods and accuracy. Findings highlight the need for age-appropriate diagnostic guidelines and tailored interventions for adults.

**Conclusion:** There is an urgent need for research into adult-specific APD diagnostic criteria and assessment tools. Addressing these gaps can enable timely diagnosis for adults with APD. Our results provide a foundation for future research towards developing a standardized, evidence-based framework for diagnosing APD in adult populations.



## AUDIOLOGIST'S VIEW ON APPLICATION OF ARTIFICIAL INTELLIGENCE IN HEARING AIDS.

**Audiology Student Mohammed Al Mansour**<sup>1</sup>, Audiology student SALEH ALWADIE<sup>2</sup>

<sup>1</sup>King Khalid University, Abha, Saudi Arabia, <sup>2</sup>King Khalid University, Abha, Saudi Arabia

**Background:** “Artificial intelligence (AI) is revolutionizing the listening experience for hearing aid users”. However, its impact on audiologists' satisfaction of fitting hearing aids is underexplored. The present study explores to understand the audiologists' views about the hearing aids integrated with AI.

**Methods:** A questionnaire was developed and validated to assess audiologists' views on application of AI in hearing aids.

**Results:** The questionnaire was distributed to 759 audiologists and 312 responses were obtained (41%). 282 audiologists have answered all the questions, and they were analysed. Among the 282 responses, 84 (30%) were females and 198 were males. Majority of audiologists were aware of AI technology in hearing aids and expressed positive views on the hearing aid benefit. Approximately 90% of audiologists agree that hearing aids integrated with AI, improves speech clarity, reduces noise and improves the quality of sound. However, 60% audiologist noted technical glitches and its impact on the ease of use. Further, approximately 40% audiologists also highlighted the need for ongoing training and support to fully leverage AI capabilities.

**Conclusion:** AI significantly improves hearing aid user experiences. But there were some challenges that need to be addressed. Continue training of professionals from manufactures is critical factor. Further studies are wanted in specific application of AI in hearing aid technology and fitting processes at various levels of hearing aid verification processes.

# USE OF ARTIFICIAL INTELLIGENCE IN THE DIAGNOSTIC HYPOTHESIS OF PURE-TONE AUDIOMETRY: A SCOPING REVIEW

**Guilherme Lopes De Oliveira**<sup>1</sup>

<sup>1</sup>Universidade Federal De Sergipe, Lagarto, Brazil

**Background:** Hearing loss affects millions of people worldwide, impacting their communication, cognition, and quality of life. Early and accurate diagnosis is crucial, with Pure Tone Audiometry (PTA) currently regarded as the gold standard. However, PTA faces challenges such as reliance on specialists, inter-examiner variability, and time-consuming processes. This study aimed to explore how AI can enhance diagnostic accuracy and efficiency in PTA, focusing on Brazilian standards.

**Methods:** This study followed the PRISMA-ScR (2018) guidelines to address the question: "How can AI improve the accuracy and speed of diagnostic hypotheses for hearing loss in Pure Tone Audiometry?" After excluding duplicate articles and applying rigorous criteria, nine studies were included. Data were extracted on authors, publication year, types of AI used, key findings, and limitations.

**Results:** The nine included articles demonstrated varied approaches, such as supervised learning for audiogram classification, unsupervised learning for pattern identification, and Bayesian models for dynamic threshold estimation. However, limitations were identified, including a lack of validation in diverse clinical settings, technical challenges, and ethical concerns.

**Conclusion:** The transformative impact of AI was highlighted, particularly its potential to democratize access to hearing diagnostics, especially for populations with limited access to specialists. Nonetheless, barriers such as data privacy, resistance from professionals, and the need for standardization remain significant challenges. The advancements presented suggest that AI has substantial potential to redefine audiology practice, offering faster, more accurate, and accessible diagnostics. However, the impact of these technologies depends on overcoming technical, ethical, and regulatory challenges, ensuring that benefits are equitably distributed across diverse socioeconomic contexts.

# ARTIFICIAL INTELLIGENCE IN TYMPANOMETRY: A SCOPING REVIEW

**Guilherme Lopes De Oliveira**<sup>1</sup>

<sup>1</sup>Universidade Federal De Sergipe, Lagarto, Brazil

**Background:** Artificial Intelligence (AI) has been revolutionizing the field of auditory health by enabling significant advances in diagnosis and treatment. However, limitations in conventional methods, such as subjective interpretation and human variability, highlight the need for more precise solutions. This study aims to explore how AI can contribute to enhancing tympanometry.

**Methods:** A scoping review was conducted following the PRISMA-ScR 2018 protocol to address the question: "How can AI contribute to tympanometry?" The search utilized descriptors specified in DeCS/MeSH: ("Artificial Intelligence" OR "Machine Learning") AND ("Acoustic Impedance Tests"), covering articles published between 2014 and 2024, in English and Portuguese, with open access. The databases searched were PubMed and Biblioteca Virtual em Saúde (BVS).

**Results:** The analyzed articles demonstrated promising advancements with the use of AI in tympanometry. The first study developed machine learning algorithms to classify energy absorption data at different frequencies, enabling the automatic identification of key regions in tympanometric tracings. The second study employed a hybrid deep learning model to classify tympanometric tracings into types A, B, and C. Both studies emphasized reduced analysis time and increased reliability of results.

**Conclusion:** The findings suggest that AI has the potential to transform tympanometry by improving accessibility and diagnostic accuracy. However, additional research is needed to validate these models on a larger scale and integrate AI systems into clinical environments. The application of AI in tympanometry represents an important step toward modernizing audiological practice and expanding access to quality auditory care.

## AUDIOMETRIC AND SELF-REPORTED OUTCOMES IN PATIENTS WITH OTOSCLEROSIS AND SMALL AIR-BONE GAP AFTER STAPES SURGERY

Henryk Skarzynski<sup>1</sup>, Beata Dziendziel<sup>2</sup>, Elzbieta Gos<sup>3</sup>, **Prof. Piotr Henryk Skarzynski**<sup>3,4</sup>

<sup>1</sup>Otorhinolaryngosurgery Clinic, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany, Poland, <sup>2</sup>Implant and Auditory Perception Department, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany, Poland, <sup>3</sup>Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany, Poland, <sup>4</sup>Institute of Sensory Organs, 05-830 Kajetany/Warsaw, Warsaw, Poland

**Background:** The main determinant in deciding on stapes surgery in patients with otosclerosis is the degree of hearing loss, specifically the size of the preoperative air-bone gap (ABG). The debate over the minimum ABG centers on the risk-to-benefit ratio of stapes surgery in patients with small ABG (sABG). The aim of this study was to measure the audiological outcomes and self-assessed satisfaction in a group of otosclerosis patients with an sABG who underwent stapedotomy.

**Methods:** There were 83 patients with preoperative sABG  $\leq 25$  dB HL (mean of 500, 1,000, 2,000, 4,000 Hz) included in this study. Audiometry was performed before surgery and 6 months and 12-36 months after surgery. Self-reported patient outcomes before and after surgery were collected using questionnaires.

**Results:** At the 6-month follow-up, the ABG was closed within 10 dB in 63 (78.8%) cases. Preoperatively, tinnitus was present in 70% of patients, of which 66% reported that tinnitus was a moderate or severe problem. Postoperatively, 71% of patients experienced a significant reduction in tinnitus severity and 34% of them reported complete disappearance. The self-report outcomes relating to quality of life and hearing reflected a good level of satisfaction in most patients.

**Conclusion:** The possibility of reducing bothersome tinnitus after stapes surgery and thus improving the patient's quality of life should be taken into account when making a decision on stapes surgery in these patients.

## FAILURES AFTER COCHLEAR IMPLANT SURGERY IN PROFOUND HEARING LOSS AND DEAFNESS

**PROF. Jarosław Markowski<sup>1</sup>**, MD, Ph.D. Lucyna Klimczak - Gołąb<sup>1</sup>, MD, Ph.D. Katarzyna Przytuła-Kandzia<sup>1</sup>

<sup>1</sup>Department of Laryngology Faculty of Medical Sciences Medical University of Silesia, Katowice, Poland

**Background:** Human speech is the most important way of communication between people. For its proper development, good hearing is crucial. It is estimated that around 12% of the human population has hearing loss. An increasing number of people with hearing loss are observed. If the classic hearing aid gives no benefit we should consider improving hearing and speech understanding through cochlear implant surgery. To achieve the intended patient-satisfying effect, it is needed to carry out correctly: 1) qualification for implantation 2) surgical procedure 3) processor fitting and rehabilitation.

**Methods:** The cochlear implant treatment program was established in our Department in 2004. We have analyzed 216 patients aged 4 to 87 years (average age 45) after cochlear implantation within 20 years.

Failures in the treatment of hearing loss / deafness by cochlear implantation may be associated with: 1) insufficient diagnosis and, as a result, incorrect qualification 2) complications associated with surgery 3) inappropriate: rehabilitation or lack of wearing a processor and difficulties in fitting. We have divided failure groups into small and large.

**Results:** In our material, the percentage of major failures ranged from 0.3 to 9.5%, while the percentage of small failures ranged from 0.3% to 0.5%.

**Conclusions:** In our opinion, it is extremely important to conduct analysis and follow-up of surgical procedures, including cochlear implantation. This allows us to improve the methods used, avoid the same failures and thus provide better patient care.

## Free Paper Session 10 - Hearing Aids

Herrensaal, May 16, 2025, 13:25 - 14:55

### SELF-DIRECTED GAIN SELECTION BASED ON SPEECH MCL MEASUREMENTS

**Master's student Esben Adelhelm**<sup>1,2</sup>, PhD Anthea Bott<sup>3</sup>, Professor Tobias Neher<sup>1,2</sup>, Assistant professor Michal Fereczkowski<sup>1,2</sup>

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**Background:** Hearing-aid gain is typically prescribed based on clinically measured audiograms. In out-of-clinic settings, audiograms cannot be reliably measured due to issues with noise and calibration. The most comfortable level (MCL) for speech could offer a viable alternative to audiogram-based gain prescription. However, current MCL measurement methods are often ineffective. This study evaluates a new method for measuring the speech MCL, utilizing pairwise comparisons combined with a Gaussian-process backend. Furthermore, it investigates the utility of this method for determining most preferred gain settings (MPGS).

**Methods:** Fifteen normal-hearing and 15 hearing-impaired participants were tested. The new method was compared to a standard bracketing method in terms of precision, test duration, and test-retest reliability. The new method was also used for measuring MPGS for speech listening, without a priori knowledge of the individual audiograms. MPGS were determined based on a range of gain presets derived using the NAL-NL2 fitting rule and several standard audiograms. The determined MPGS were then compared to NAL-NL2-based gain settings prescribed for the individual audiograms.

**Results:** Data collection is currently ongoing. First results for the MCL measurements indicate similar precision and test duration for the two methods. We hypothesize that the new method will provide better test-retest reliability. We also hypothesize that the new method will provide a viable means for self-directed gain selection.

**Conclusion:** The results will provide insights into the utility of the new method for self-directed gain selection based on speech MCL measurements.

## PRELIMINARY INVESTIGATIONS WITH HEARING-AID DATALOGGING: CAN THE NOISE MANAGEMENT LEVEL OF THE HEARING-AID INFLUENCE THE TIME SPENT IN DIFFERENT SOUND ENVIRONMENTS?

**Dr Monica Ashokumar**<sup>1</sup>, Magnus Bøje Madsen<sup>1</sup>

<sup>1</sup>Demant A/S, Copenhagen, Denmark

**Background:** Noise management in hearing-aids is intended to improve the listening experience for users in various sound environments. Evaluating time spent in different sound environments can help assess the benefits of these features. Most hearing-aid models include datalogging capabilities, which record the sound environment classification computed over time. This study uses datalogging to determine if the level of noise management can predict the time spent in different listening situations.

**Methods:** Datalogging information from 516 hearing-aid users were extracted from a large-scale internal database. Out of these, 306 used a hearing-aid model with advanced noise management (HA-A) and 210 used a hearing-aid model with basic noise management (HA-B). The percentage of time spent in quiet, noisy and very noisy environments was recorded between the initial and follow-up visits between March to August 2024 and these were used for analysis.

**Results:** Results show that overall users spend around 53.7% of their time in quiet, 27.7% in noisy and 18.5% in very noisy environments. More specifically, HA-A users spent significantly more time in noisy environments when compared to HA-B users ( $F(1,514)=13.33$ ,  $p < 0.001$ ) and vice versa in the quiet environments ( $F(1,514)=11.94$ ,  $p < 0.001$ ).

**Conclusion:** Preliminary findings indicate that advanced noise management features may result in relatively increased time spent in challenging situations, possibly reflecting a more active lifestyle. Additionally, this study highlights the value of datalogging for understanding user habits and preferences. Further research is needed to explore other factors that may influence the time spent in challenging situations.

## IMPROVING HEARING AID OUTCOME AT MODERATE TO HIGH SPEECH LEVELS

**Lukas Jürgensen**<sup>1,2</sup>, Michal Fereczkowski<sup>1,2</sup>, Tobias Neher<sup>1,2</sup>

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**Background:** While a level increase typically improves speech intelligibility (SI) at low presentation levels, it can lead to poorer SI at high levels. In the audiological literature, this phenomenon has been termed rollover (RO). In an earlier study, we introduced ‘sweet-spot compression’ (SSC) – a new fitting strategy that aims to prevent RO by placing speech in that area of an individual’s performance-intensity function where SI and listening comfort are high. Using a proof-of-concept approach, we showed that SSC can prevent RO at high levels, unlike a clinical reference condition. At low levels, however, participants preferred the reference condition. Here, we present follow-up research aimed at improving and evaluating SSC further.

**Methods:** A wearable research hearing aid was used to implement SSC with a revised gain prescription at low levels and a clinical reference condition (NAL-NL1). Seventeen randomly selected hearing-impaired listeners were tested. SI was assessed at 65 and 80 dB SPL in the presence of noise. Perceived speech quality was assessed in quiet and in noise at several levels.

**Results:** Relative to NAL-NL1, SSC gave better SI at both presentation levels and was also clearly preferred in several sound scenarios. At the group level, RO occurred with neither SSC nor NAL-NL1. At the individual level, fewer RO cases were found with SSC than with the reference condition.

**Conclusion:** SSC shows promise in terms of improving aided outcome at moderate to high speech levels. Individuals with clear RO likely benefit most from more individualized gain prescription at higher levels.



## HEARING LOSS: SOCIAL STEREOTYPES

### **Associate Professor Mariia Markova**

<sup>1</sup>Russian Medical Academy of Continuous Professional Education, Department of Clinical Audiology, Moscow, Russia

**Background:** The loss of function of any organ results in a decline in the quality of life, including auditory function. The concept of health-related quality of life has allowed us to identify parameters that describe the state of health, its maintenance, and the quality of healthcare.

In assessing the quality of life, it is crucial to understand that what is being evaluated is not the severity of the pathological process itself but rather how the patient experiences their illness and assesses the medical care they receive.

**Methods:** In 2024, as part of the World Hearing Forum's program (WHO) for preventing ear and hearing disorders, our team participated in research efforts.

A survey was conducted among 50 individuals, involving a personalized video interview with five open-ended questions about hearing impairments and hearing aids.

The participants were adults, the majority of respondents were male. The participants were not medical professionals.

**Results:** Most of participants indicated that they would use hearing aids if recommended by a medical professional. However, nearly all of them expressed concerns about potential stigma, including fear of public judgment, the social perception of deafness, and feelings of discomfort. And only one of them turned out to be positive about the problem of hearing impairment.

**Conclusion:** To maintain a high standard of living under any circumstances, it is essential to transcend preconceived notions and delve into the essence of individuals, recognizing their distinctiveness and inherent characteristics. It is imperative not to let stereotypes dictate one's identity or constrain their potential.

## OBJECTIVE VERIFICATION OF HEARING AID OUTPUT AND FUNCTIONS: INFLUENCE ON PEDIATRIC AMPLIFICATION EFFECTIVENESS

**Assoc.prof. Gaziz Tufatulin**<sup>1,2,3</sup>, Prof. Sergey Artyushkin<sup>3</sup>, Prof. Vladimir Dvoryanchikov<sup>1</sup>

<sup>1</sup>Scientific ENT Research Institute, St Petersburg, Russia, <sup>2</sup>Center of Pediatric Audiology, St Petersburg, Russia, <sup>3</sup>North-Western State Medical University named after I.I. Mechnikov, St Petersburg, Russia

Background: Progress in hearing aids' (HA) technologies requires the objective evidence of safety and effectiveness for children.

Methods: The effectiveness of two approaches were compared. Standard protocol (control group) based on the subjective verification. Experimental protocol suggests an objective electroacoustic verification (in real ear or 2cc coupler) of the output and HA functions: feedback cancellation, amplitude and frequency compression, microphone directionality, digital noise reduction (experimental group). Each group consisted 56 children (3–17 y.o.) with hearing loss from moderate to moderately-severe degree. Initial amplification was performed for each child; results were estimated in 1, 3 and 6 months using PEACH and LIFE questionnaires, speech audiometry, phoneme testing, DataLogging and first fitting appointment time.

Results: In preschoolers of the experimental group post-amplification PEACH results were 6% better than in controls. In school-age children (LIFE questionnaire) results were 11% better comparing with controls. Speech intelligibility in quiet was 3.1% ( $p > 0.05$ ) higher for pre-schoolers in the experimental group and 9.3% ( $p < 0.01$ ) higher for school-age children comparing with control. Speech intelligibility in noise was higher in experimental group than in control: 7.8% ( $p < 0.05$ ) in pre-schoolers and 13% ( $p < 0.01$ ) for school-age children. Phoneme recognition was better in experimental group as well: 4.5% ( $p < 0.05$ ) in pre-schoolers and 9.8% ( $p < 0.01$ ) in school-agers than in controls. After HA fitting following an experimental protocol DataLogging time was 11–12% longer. Experimental protocol took in average 1.5 hours for the first fitting, standard protocol — 53 minutes.

Conclusion: Objective electroacoustic verification of HA output and functions significantly increases the effectiveness of amplification in children.

# EXPLORING REAL-WORLD LISTENING MOTIVATION IN HEARING AID USERS: THE INTERPLAY OF ACOUSTIC FACTORS, HEART RATE, AND LISTENING INTENT

**Klaudia Andersson**<sup>1,2</sup>, Principal Scientist Jeppe Christensen<sup>3</sup>, Postdoc Research Fellow Jack Holman<sup>4</sup>, Professor Tobias Neher<sup>1,2</sup>

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**Background:** Previous research using ecological momentary assessment (EMA) has shown that various factors, including listening intent, acoustic conditions, and physiological responses, are associated with real-world listening experiences. Listening experiences have also been linked to listening motivation, which drives engagement in a listening task. The current study investigated the interplay between ambient acoustics, physiological measures, and listening intent with listening motivation in the real-world settings encountered by a group of hearing aid (HA) users.

**Methods:** Twenty-five adults with symmetrical mild-to-moderate hearing losses were fitted with test HAs. Over a 2-week period, they completed EMAs throughout the day using a smartphone EMA-app. In the encountered situations, they also rated the importance to hear well. The HAs logged the ambient sound pressure level and signal-to-noise ratio every 20 sec. Research-purpose wristbands worn by the participants were used to collect continuous heart rate data.

**Results:** Importance ratings were positively associated with measures of continuous heart rate during conversations with one person in relatively quiet sound environments. Supplementary analyses revealed that heart rates categorized as ‘high’ were linked to a greater importance to hear well during conversations with several people in relatively loud sound environments.

**Conclusions:** These exploratory results suggest that increased physiological arousal, as reflected by higher heart rate, is associated with greater listening motivation during speech communication compared to other listening intents. Furthermore, the findings suggest that the association between physiological arousal and motivation is influenced by the ambient acoustics.

## HEARING AID USE AND SPEECH RECOGNITION IN OLDER ADULTS: PRELIMINARY FINDINGS FROM A SIX-MONTH FOLLOW-UP

Ms. Liat Liat Shechter-Shvartzman<sup>1</sup>, Prof. Karen Banai<sup>1</sup>, **Dr. Limor Lavie**<sup>1</sup>

<sup>1</sup>University Of Haifa, Department Of Communication Sciences And Disorders, Haifa, Israel

**Background:** The benefits of using hearing aids vary widely across listeners with age-related hearing loss. In this longitudinal study we examine the contribution of hearing aids to the recognition of degraded speech, and ask whether perceptual benefits change over time.

**Methods:** 31 first-time hearing aid users (ages 67-88, M=77) and 20 non-users (ages 63-87, M=75) participated. Recognition of fast speech and speech in babble noise, with and without hearing aids, was assessed at three time points over a six-months period. First-time hearing aid users were first tested shortly prior to hearing aid fitting, two to three months post-fitting, and six months post-fitting. Non-users were tested in similar time intervals, but did not use hearing aids between the tests. We analyzed the effects of time, amplification (aided/unaided), hearing loss severity, and their interactions on speech perception.

**Results:** Amplification improved fast speech recognition for both groups, and the magnitude of improvement changed over time. Hearing aid use benefited participants with moderate hearing loss more than those with mild loss. Amplification also enhanced speech in noise recognition for both groups.

**Conclusion:** The contribution of hearing aids to speech recognition is complex. Hearing aid benefits depend on hearing aid use and hearing level. Both fast speech and speech in noise recognition improve with amplification.

## INDIVIDUALS WITH NEAR-NORMAL AUDIOMETRIC THRESHOLDS BUT PERCEIVED HEARING DIFFICULTIES SHOW AIDED OUTCOMES ON PAR WITH THOSE OF PEERS WITH MILD OR MODERATE HEARING LOSSES

Larry E. Humes<sup>1</sup>, Dr. Sreeram K. Narayanan<sup>2</sup>, Prof. Dr. Jesper H. Schmidt<sup>2,3</sup>, Prof. Dr. Dorte Hammershøi<sup>4</sup>, **Prof. Dr. Tobias Neher**<sup>2</sup>

<sup>1</sup>Indiana University, Bloomington, USA, <sup>2</sup>University of Southern Denmark, Odense, Denmark, <sup>3</sup>Odense University Hospital, Odense, Denmark, <sup>4</sup>Aalborg University, Aalborg, Denmark

**Background:** Individuals with audiometrically normal hearing can experience hearing difficulties and could therefore benefit from hearing aid treatment. To test this hypothesis, the current study examined self-reported hearing difficulties, before and after hearing aid intervention, in a clinical sample tested as part of the Danish 'Better hEARing Rehabilitation' (BEAR) project.

**Methods:** Self-reported hearing abilities were assessed using the 12-item Speech, Spatial and Qualities of Hearing (SSQ12) scale and compared before and after hearing aid intervention. In addition, daily hearing aid usage and International Outcome Inventory for Hearing Aids (IOI-HA) scores were examined. The participants were individuals seeking treatment at two large public hearing clinics. They were segregated into three groups based on their better-ear four-frequency pure-tone average (PTA4) hearing loss: (1) 'normal hearing' (N = 82), (2) 'mild hearing loss' (N = 449), and (3) 'moderate hearing loss' (N = 430).

**Results:** Pre-intervention SSQ12 scores were comparable for the three participant groups. Post-intervention scores for the different outcome measures were generally also comparable, with only a few statistically significant differences between the 'normal hearing' and 'moderate hearing loss' groups.

**Conclusion:** The presence of PTA4-based normal hearing should not preclude individuals from consideration for hearing aid treatment. When assessing candidacy, perceived hearing difficulties should also be considered.

## Free Paper Session 11 - Auditory Implants (Part 4)

Prälatensaal, May 16, 2025, 13:25 - 14:55

### AUDITORY DEVELOPMENT OF YOUNG CHILDREN WITH PROFOUND HEARING LOSS, COCHLEAR IMPLANTS AND CONGENITAL CMV INFECTION

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**Background:** The aim of the study was to assess auditory development in young children with profound hearing loss, cochlear implants (CIs) and congenital cytomegalovirus (cCMV) infection and to determine the effect of comorbidities on their development.

**Methods:** The study group (cCMV group) consisted of 47 CI children—18 girls and 29 boys—who had been diagnosed as having prelingual hearing loss due to cCMV infection (with or without comorbidities); the mean age at CI activation was 15.2 months (range: 9.7–23.8; SD = 3.5). The reference group (no cCMV) consisted of 117 similar children (57 girls and 60 boys) who had profound sensorineural hearing loss not caused by cCMV infection; they had no comorbidities. The mean age at CI activation in the second group was 14.3 months (range: 7.9–23.5; SD = 4.0). Auditory development in all children was assessed with the LittleEARS Auditory Questionnaire (LEAQ) at CI activation and at about 1, 5, 9, 14, and 24 months of CI use.

**Results:** The mean LEAQ total score increased over a similar time frame from 9.8 pts to 28.9 pts in the cCMV group without comorbidities, from 4.5 pts to 18.5 pts in the cCMV group with comorbidities, and from 9.2 to 31.6 pts in the reference group with no cCMV infection.

**Conclusion:** Early cochlear implantation in children with sensorineural hearing loss due to congenital CMV infection and no comorbidities promotes their early auditory development in a similar way to children without cCMV infection.

## SUBJECTIVE BENEFIT AFTER COCHLEAR IMPLANTATION IN DIFFERENT GROUPS OF PATIENTS

MEng Kornelia Zawistowska<sup>1</sup>, Ass. Prof. Anita Obrycka<sup>1</sup>, **Prof. Artur Lorens<sup>1</sup>**, MEng Tomasz Wiśniewski<sup>1</sup>, Prof. Henryk Skarżyński<sup>1</sup>

<sup>1</sup>World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany, Poland

**Background:** Historically, cochlear implantation was only considered in the case of individuals with bilateral profound sensorineural hearing loss (CI). As technology and knowledge about hearing loss developed, the criteria for qualifying for a cochlear implant expanded for people with partial deafness (PDT), asymmetric hearing loss (AHL) and single-sided deafness (SSD). The comparison of the outcome of cochlear implantation using audiological tests is difficult in the case of groups with different degrees and configuration of hearing loss. A valuable instrument to measure that CI outcome are auditory questionnaires. Therefore, the aim of this study was to compare the results without and with the cochlear implant in four subgroups using APHAB questionnaire.

**Methods:** A comparative study was conducted between four subgroups of cochlear implant users (CI with n= 154, PDT with n= 130, AHL with n= 86 and SSD with n= 93) with average period of experience as 18,98 months. The APHAB questionnaire was used to assess auditory functioning. The global scores of the questionnaire were analyzed.

**Results:** The APHAB scores showed the significant decrease of perceived difficulties in auditory functioning in all subgroups after CI. Only SSD group differed significantly having less benefit than others.

**Conclusion:** The expansion of qualification criteria enabled patients with varying degrees and patterns of hearing loss to benefit from cochlear implantation.

# COCHLEAR IMPLANTATION: LONG-TERM EFFECT OF EARLY ACTIVATION ON ELECTRODE IMPEDANCE

**Dr Yassin Abdelsamad**<sup>1</sup>

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**Objectives:** The growing adoption of cochlear implants (CIs) necessitates understanding the factors influencing long-term performance and improved outcomes. This work investigated the long-term effect of early activation of CIs on electrode impedance in a large sample of CI users at different time points.

**Methods:** A retrospective study on 915 ears from CI patients who were implanted between 2015 and 2020. According to their CI audio processor activation time, the patients were categorized into early activation (activated 1 day after surgery, n = 481) and classical activation (activated 4 weeks after surgery, n = 434) groups. Then, the impact of the activation times on the electrode impedance values, along the electrode array contacts, at different time points up to two years was studied and analyzed.

**Results:** The early activation group demonstrated lower impedance values across all the electrode array sections compared to the classical activation at 1 month, 1 year, and 2 years post-implantation. At 1 month, early activation was associated with a reduction of 0.34 k $\Omega$ , 0.46 k $\Omega$ , and 0.37 k $\Omega$  in the apical, middle, and basal sections, respectively. These differences persisted at subsequent intervals.

**Conclusions:** Early activation leads to sustained reductions in the electrode impedance compared to classical activation (CA), suggesting that earlier activation might positively affect long-term CI outcomes.



## CAN AN INDIVIDUAL WITH LOW FREQUENCY HEARING IS THE CANDIDATE EAR BENEFIT FROM A COCHLEAR IMPLANT EVEN IF THY HAVE NORMAL HEARING IN THE OTHER EAR?

Prof. Artur Lorens<sup>1</sup>, **Prof. Piotr Henryk Skarzynski**<sup>2,3</sup>, Anita Obrycka<sup>1</sup>, Henryk Skarzynski<sup>4</sup>

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**Background:** To determine hearing preservation and subjective benefit after cochlear implant (CI) surgery in patients with low frequency hearing in the ear to be implanted (i.e., they have partial deafness, PD) and close to normal hearing in the other.

**Methods:** The test group was made up of 12 adult patients (mean age 43.4 years; SD 13.6) with normal hearing or mild hearing loss in one ear, and with PD in the ear to be implanted. The reference group consisted of 12 adult patients who had PD in both ears and who underwent unilateral implantation in their worse ear. Hearing preservation was assessed 1 and 14 months after CI surgery. The APHAB questionnaire was used to evaluate the benefit from the CI.

**Results:** The differences in HP% between the groups were not significant: mean hearing preservation (HP%) in the test group was 82% one month after CI surgery and 75% some 14 months after implantation; corresponding results in the reference group were 71% and 69%. However, on the APHAB background noise subscale, the benefit in the test group was significantly larger than in the reference group.

**Conclusion:** To a large extent it was possible to preserve low-frequency hearing in the implanted ear. This means that individuals with low frequency hearing in the implanted ear and with normal hearing in the other generally received more benefits from cochlear implantation than did patients with partial deafness in both ears.

## VIBRANT SOUNDBRIDGE IMPLANTATION: BILATERAL BENEFITS

**Maria Peixoto**<sup>1</sup>, AUD Cristina Miranda<sup>1</sup>, MD Victor Correia da Silva<sup>1</sup>

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**Background:** With an experience of more than 25 years Vibrant Soundbridge has demonstrated to be a safe and reliable implant for patients with moderate-to-severe sensory hearing loss. After years of use, indication criteria have been extended to mixed hearing loss, malformations and in pediatric population.

After the good results that has been presented with unilateral implants, can we find advantages in a bilateral implantation? Will this bilateral implantation have benefits that outweigh the risks of another surgery and will there be a cost-benefit ratio?

This study aims to evaluate the benefit of bilateral Vibrant Soundbridge implantation.

**Methods:** A retrospective study of 6 patients with symmetrical sensorineural hearing loss who were implanted sequentially in both ears with Vibrant Soundbridge was done. The performance of each patient was compared under three conditions: with the first implant activated, with the second implant activated and with both implants activated. Motivation for the second implant was questioned as well as subjective benefits.

**Results:** The good performance with the first implant was the major indication for the second implant. Patients report being satisfied with both implants. None of the patients reported interference in auditory performance or comprehension with the 2 implants.

In the audiometric evaluation, the results with the second implant appeared to be slightly worse than the first one, but it was possible to observe a gain of 5,5 dB when both implants were activated compared with the first implant. Speech discrimination and hearing in noise also improved.

**Conclusion:** Bilateral implantation with Vibrant Soundbridge seem to improve hearing results.

# A NOVEL METHOD TO DETERMINE THE MAXIMUM OUTPUT OF A TRANSCUTANEOUS ACTIVE BONE CONDUCTION IMPLANT USING ONLY THE AUDIOMETRIC PATIENT DATA

**Dr. Mohammad Ghoncheh**<sup>1,2</sup>, Dr. Susan Busch<sup>1,2</sup>, Prof. Thomas Lenarz<sup>1,2</sup>, Prof. Hannes Maier<sup>1,2</sup>

<sup>1</sup>Hannover Medical School, Department of Otorhinolaryngology, Hannover, Germany, <sup>2</sup>Cluster of excellence Hearing4all, Hannover, Germany

**Introduction:** Knowledge of maximum output (MO) of acoustic devices including implantable bone conduction devices for candidates is a crucial factor to provide satisfying speech intelligibility after implantation. Here, we present a method using only audiological routine data of the patients to determine the MO of a transcutaneous bone conduction implant (Bonebridge, MEDEL, Austria).

**Method:** The maximum output in terms of hearing level (MOHL) [dB HL] of the Bonebridge was determined by evaluating patients' bone conduction (BC) thresholds and direct thresholds determined behaviorally via the device (Vibrogram). The study included patients implanted with the Bonebridge between 2011 and 2020, with an average age of  $45 \pm 19$  years (range: 5–84 years). MOHL analysis was conducted by categorizing values based on frequency-specific BC thresholds, distinguishing between better and worse thresholds on the ipsilateral (implanted) side because only unmasked direct thresholds were available.

**Results:** The average ipsilateral MOHLs ranged from 51 to 73 dB HL for frequencies between 0.5 and 6 kHz on the ipsilateral ear. In contrast, the average contralateral MOHLs ranged from 43 to 68 dB HL. Across frequencies, the average MOHLs were 4 to 8 dB higher in the group with better BC thresholds on the ipsilateral ear compared to the group with better contralateral BC thresholds. These differences were statistically significant (t-test;  $p < 0.05$ ).

**Conclusion:** The proposed method, applicable to all acoustic implants, uses patient data from clinical routine, specifically direct and bone conduction thresholds, to determine frequency-specific MOHL.

## REAL-WORLD EVIDENCE REVEALS SUPERIOR OUTCOMES OF BILATERAL COCHLEAR IMPLANT USERS: INSIGHTS FROM THE COCHLEAR FAMILY SURVEY

**Dr. Giedre Stripeikyte**<sup>1</sup>, Herbert Mauch<sup>1</sup>, Dr. Chris James<sup>2</sup>

<sup>1</sup>Cochlear AG, Basel, Switzerland, <sup>2</sup>Cochlear France, Toulouse, France

**Background:** Direct user experience reports provide invaluable insights into the perceived benefits and performance of cochlear implant (CI) systems. Utilizing this information helps to better understand perceived side effects, track MRI experiences, and assess hearing performance, which is typically evaluated only in clinical settings.

**Methods:** The Cochlear Family Survey is an online tool designed to collect data on the performance and safety of CI systems as part of ongoing post-market clinical follow-up under EU MDR. It is distributed to Cochlear Nucleus CI recipients who are part of the Cochlear Family scheme. Participants provide feedback on their experiences with their CI systems.

**Results:** The survey was distributed across 11 countries within the EMEA region, available in 7 local languages. Responses were received from over 3000 CI recipients. Subjective hearing performance, measured by SSQ12, were found within expected values. Notably, bilateral CI recipients demonstrated superior outcomes, with significantly higher SSQ12, confidence, and satisfaction scores compared to unilateral CI recipients and bimodal CI users. Additionally, recipients who did not report any issues or side effects had higher SSQ12, confidence, and satisfaction scores compared to those who reported any.

**Conclusion:** The Cochlear Family Survey effectively captures user-reported data on CI system performance and safety. The findings underscore the importance of direct user feedback in understanding the real-world performance of CI systems and highlight the need for ongoing post-market surveillance to ensure optimal patient outcomes. The superior performance of bilateral CI recipients emphasizes the potential benefits of bilateral implantation in enhancing user satisfaction and confidence.

# EXPLORING AUDIOVISUAL INTEGRATION AND SPEECH RECOGNITION IN NOISE: A COMPARISON BETWEEN COCHLEAR IMPLANT USERS AND NORMAL HEARING ADULTS

**Ahsen Kartal Özcan**<sup>1,2</sup>, Ayça Çiprut<sup>3</sup>

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**Background:** Audiovisual integration, a crucial multisensory ability, plays a significant role in speech perception and provides a perceptual advantage, particularly in noisy environments. This study aimed to compare sentence recognition in noise and audiovisual integration between young adults with cochlear implants (CI) and those with normal hearing (NH). Additionally, it sought to examine the correlation between these tests of results.

**Methods:** The study included 30 NH individuals, and 30 CI users aged 18-30, all without otologic, neurological, or psychological disorders. The assessment of sentence recognition in noise was conducted using the Turkish Matrix (TurMatrix) Test at a +15 signal-to-noise ratio. Audiovisual integration was tested across four conditions: auditory-only, visual-only, congruent audiovisual, and incongruent audiovisual. Group differences were analyzed, and correlations between test results were examined.

**Results:** Significant differences were found between the NH and CI groups in TurMatrix, auditory-only, visual-only, congruent audiovisual, and incongruent audiovisual conditions ( $p < 0.05$ ). Positive correlations emerged between TurMatrix scores and auditory-only, congruent audiovisual, and fusion response percentages ( $p < 0.05$ ). Reaction times in all audiovisual tasks negatively correlated with TurMatrix scores ( $p < 0.05$ ). No significant correlations were observed between TurMatrix and visual-only response percentages ( $p > 0.05$ ).

**Conclusion:** These findings show distinct audiovisual integration patterns between CI users and NH individuals. The positive correlation between audiovisual integration and speech recognition underscores the importance of multisensory processing in enhancing communication, particularly for CI users. The results highlight the need for rehabilitation strategies that focus on strengthening audiovisual integration for improved speech perception in challenging environments.

## Free Paper Session 12 - Speech, Language & Music Perception

Room Hartmann, May 16, 2025, 13:25 - 14:55

### MELUDIA - MUSIC TRAINING FOR IMPROVED SPEECH PERCEPTION IN COCHLEAR IMPLANT USERS

**Teresa Schneider**<sup>1</sup>

<sup>1</sup>Lzh Dornbirn, Dornbirn, Austria

**Content:** Cochlear implantation (CI) and rehabilitation are standard procedures for hearing restoration. Integrating music into auditory rehabilitation positively impacts speech comprehension and auditory-cognitive skills. Teresa Schneider, speech therapist in Austria, presents the Meludia music training program as a complement to traditional speech exercises.

**Objective:** The aim is to explore how Meludia can enhance speech comprehension in CI users, particularly in noisy environments, by recognizing speech melody, improving attention, and boosting auditory memory. Prosody, as a bridge between music and language, is targeted through nonverbal musical exercises, which directly improve speech-related parameters.

**Method:** Therapists assess the client's speech comprehension and challenges with speech melody. Nonverbal musical exercises with Meludia are used to target these areas, followed by corresponding speech exercises. The program can be practiced individually at home or during therapy sessions. After a few sessions, progress is evaluated to adjust training.

**Results:** After two years of incorporating Meludia, it has proven both enjoyable and effective for CI users of all ages. The program improves speech comprehension and key auditory skills, including prosody recognition, attention, and auditory memory. Clients show high engagement and motivation, as they recognize their progress and enjoy the musical exercises, which makes the program a valuable addition to CI rehabilitation.

**Discussion:** Meludia offers an innovative, engaging approach to hearing rehabilitation, complementing traditional therapy to improve speech understanding and auditory perception. It has become an essential part of CI rehabilitation and is integrated into daily training routines.

# AUDITORY CONTRIBUTIONS TO LISTENING DIFFICULTIES IN CHILDREN WITH LANGUAGE CONDITIONS

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**Background:** Listening difficulties are commonly observed in children with neurodevelopmental conditions, such as language conditions. We investigated the peripheral hearing status of a group of children with delayed or disordered language development (N = 12, six female), compared to age-matched children with typical development (N = 24), and explored whether hearing outcomes were associated with listening and language ability.

**Methods:** All children underwent an elaborate audiological test battery, with behavioral and electrophysiological assessments, and both liminal and supraliminal tests, and a language assessment. Their parents filled-out a validated questionnaire to profile listening and language difficulties.

**Results:** All participating children had verified normal hearing for conventional frequencies, type A tympanograms and no intellectual disability. Stapedius reflex and extended high frequency thresholds, otoacoustic emission amplitudes (with and without contralateral suppression), and auditory brainstem response (inter-)latencies were not significantly different between groups ( $p > 0.05$ ). Significantly poorer speech reception thresholds for digits in noise, listening and language ability were observed in children with language difficulties ( $p < 0.01$ ). Across groups, poorer high frequency hearing thresholds ( $r = -0.44$ ,  $p < 0.01$ ) and speech-in-noise performance ( $r = 0.57 - 0.72$ ,  $p < 0.01$ ) were significantly associated with poorer listening ability. Auditory outcome measures were not associated with language scores ( $p > 0.05$ ).

**Conclusion:** High frequency hearing and speech-in-noise identification ability contribute to listening difficulties in our sample, including children with language conditions.

# EVALUATION OF THE EFFECTIVENESS OF COGNITIVE BEHAVIOR THERAPY WITH CALMS-TR IN SCHOOL-AGE CHILDREN WHO STUTTER: A PRELIMINARY STUDY

**Msc Ozge Selen Avci Can**<sup>1</sup>, Professor Suna Tokgoz Yilmaz

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**Background:** The aim of this preliminary study is to evaluate the effectiveness of cognitive behavioral therapy in school-age stuttering children with cognitive, affective, linguistic, motor and social (CALMS) assessment tool.

**Methods:** Eleven children aged 8-15 years who applied to our center for stuttering treatment were included in the study. All of the children had previously received non-cognitive behavioral therapy. We used the Stuttering Severity Assessment Tool-4 (SSI-4) for stuttering severity and CALMS for stuttering behaviors before and after 20 sessions of cognitive-behavioral therapy.

**Results:** Components of CALMS (cognitive, affective, linguistic, and social) and SSI-4 scores were assessed separately before and after cognitive behavioral therapy using Spearman correlation analysis. While there was a moderate positive correlation ( $r=0.629$ ) between only the affective component of CALMS and SSI-4 scores before therapy, no statistically significant correlation was found between all components of CALMS and SSI-4 scores after therapy ( $p>0.05$ ). When CALMS total score and SSI-4 score were compared with Wilcoxon Signed test, it was seen that the total score obtained from both assessment methods before therapy was higher than after therapy and the difference was statistically significant ( $p<0.05$ ).

**Conclusions:** As a result of our preliminary study, we found that the effectiveness of cognitive behavioral therapy in stuttering children of school age can be evaluated through CALMS. The presence of cognitive, affective, linguistic, and social components of CALMS can make a positive contribution to pre- and post-treatment evaluations with a personalized perspective.



## APPLICATIONS OF A NOVEL PHRASE-BASED SPEECH-RECOGNITION TEST USING SYNTHETIC SPEECH FOR HEARING DEVICE VALIDATIONS

**Prof. Dr. Inga Holube**<sup>1,3</sup>, Saskia Ibelings<sup>1</sup>, Jonte Kriebel<sup>1</sup>, Annabell Urban<sup>2</sup>, Prof. Dr. Pascale Sandmann<sup>2,3</sup>

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**Background:** In Germany, the Freiburg Monosyllabic Speech Test (FMS) is used to validate hearing aids and cochlear implants, although it has a low test-retest reliability. The Oldenburg Sentence Test (OLSA), a matrix test with significant training effects, is also used. To improve the properties of the speech tests, a novel phrase-based speech-recognition test with 4-word meaningful phrases, the OLPHRA, was developed.

**Methods:** The OLPHRA was created using synthetic speech. Speech recognition thresholds (SRTs), i.e., signal-to-noise ratios for a speech-recognition score of 50%, were determined for listeners with normal hearing and with hearing impairment at a noise level of 65 dB SPL. The test was also used to validate hearing aid fittings at a noise level of 45 dB SPL and to monitor speech-recognition scores in quiet during cochlear implant rehabilitation. The participants with hearing impairment also completed the FMS and OLSA.

**Results:** The OLPHRA showed a higher test-retest reliability than the FMS and a lower training effect than the OLSA. The SRTs of the OLPHRA and OLSA were comparable at a noise level of 65 dB SPL. At a noise level of 45 dB SPL, the OLPHRA showed a higher hearing aid benefit than the OLSA. For cochlear implant recipients, speech-recognition scores were comparable between the two tests.

**Conclusion:** The OLPHRA shows advantages over the FMS and OLSA and can be used for hearing device validation.

## MUSIC PERCEPTION AND ANATOMY BASED FITTING

**Luis Lassaletta**<sup>1</sup>, PhD Miryam Calvino<sup>1</sup>, Dr Isabel Sánchez-Cuadrado<sup>1</sup>, Dr Elena Muñoz<sup>1</sup>, Prof Javier Gavilán<sup>1</sup>

<sup>1</sup>La Paz University Hospital, Madrid, Spain

Aim: to compare anatomy-based fitting (ABF) vs standard fitting (SF) in terms of music perception. CI users  $\geq 18$ y with either SF or ABF and good speech outcome ( $\geq 65\%$  disyllables in silence) were enrolled.

Music tasks were assessed using the "Discovery" level of Meludia online music tool, which include Rhythm, Spatialization, Stability, Melody, and Density. Each task consists of 5 levels of difficulty. Participants were allowed a maximum of 4 attempts to complete a level.

16 CI users took part in the study: 8 using ABF, 8 with SF. There were no significant differences in age at implantation ( $51 \pm 16$  vs  $53 \pm 16$ y), time since surgery ( $2 \pm 0$  vs  $3 \pm 2$ y), or % of disyllables in silence ( $68 \pm 9\%$  vs  $77 \pm 12\%$ ) between ABF and SF groups.

Regarding Meludia scores, differences were observed between both groups:

Density, ABF participants required fewer restarts to complete the different levels ( $6 \pm 2$  vs  $10 \pm 3$ ;  $p=0.010$ ).

Spatialization, subjects with ABF needed more attempts to complete the task ( $7 \pm 1$  vs  $5 \pm 1$ ;  $p=0.021$ ).

Furthermore, the 5th level of Density was successfully completed by 63% with ABF, while none of the patients with SF did ( $p=0.013$ ).

ABF demonstrates specific musical advantages in processing multiple sounds simultaneously, particularly in the accurate identification of middle and low-frequency sounds, even with less training compared to subjects with default fitting. However, it may potentially limit the identification of high-frequency sounds. Further studies are necessary to explore additional benefits of ABF in musical skills.

## SENSITIVITY TO DIFFERENT INTERAURAL TEMPORAL CUES FOR SCHOOL-AGE CHILDREN WITH AND WITHOUT A HISTORY OF OTITIS MEDIA

**Hannah Meineke**<sup>1,2</sup>, Søren Laugesen<sup>3</sup>, Jan Wouters<sup>4</sup>, Lindsey Van Yper<sup>1,2</sup>, Professor Tobias Neher<sup>1,2</sup>

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<sup>4</sup>Experimental Oto-Rhino-Laryngology, Department of Neurosciences, KU Leuven, Leuven, Belgium

**Background:** Otitis media (OM) is one of the most common childhood diseases. It is characterized by frequently recurring episodes of inflammation of the middle ear, causing clinically significant hearing loss. Although the inflammation usually resolves with time, the induced hearing loss can have long-lasting effects because early childhood constitutes a critical period for auditory development. Previous research has found that school-age children with a history of middle-ear disease experience problems with speech understanding in spatially complex listening situations. To shed light on the underlying mechanisms, this study investigated sensitivity to different interaural temporal cues in school-aged children with and without a history of early-childhood OM.

**Methods:** Using a clinically feasible psychoacoustic test paradigm, sensitivity to interaural time differences (ITDs) in the temporal fine structure (TFS), envelope, and sharpened envelope was assessed. The participants were children aged 6-14 years with and without a history of OM (N = 2 x ~20).

**Results:** Data collection is currently ongoing. We hypothesize that sensitivity to TFS-based ITDs will be disrupted in children with a history of OM, but that their sensitivity to envelope-based ITDs will be comparable to that of the control group. We also hypothesize that, for both participant groups, sensitivity to sharpened envelope-based ITDs will be better than sensitivity to envelope-based ITDs.

**Conclusion:** The results will provide insights into the speech understanding deficits experienced by children with a history of OM. These insights are expected to inform potential rehabilitation strategies that can compensate for their deficits.

# AGE-RELATED DUAL-TASK COST OF SPEECH PERCEPTION IN QUIET AND NOISE WHILE WALKING

**Yossi Bugannim**<sup>1</sup>, PhD Alon Kalron<sup>1</sup>, PhD Liat Kishon-Rabin<sup>1</sup>

<sup>1</sup>Tel-aviv University, Tel Aviv, Israel

**Background:** Everyday tasks often require dual-task (DT), such as conversing while walking, which integrates cognitive, auditory, and motor processes. Older adults (OA) frequently struggle with such tasks due to age-related declines, resulting in Motor-Cognitive Interference (MCI). While previous research explored DT effects in controlled settings (e.g., treadmills), limited work examines natural walking under varying auditory conditions. This study is unique in its assessment of speech perception in an adaptive procedure in quiet and noise conditions, during natural walking and its application of a motor-cognitive model for analyzing interference patterns.

**Methods:** Twenty-four participants, 12 OA (mean age:  $78.9 \pm 9.4$  years) and 12 younger adults (YA, mean age:  $34.9 \pm 2.4$  years), completed single-task (ST) and DT assessments. Speech reception threshold (SRT) was measured using the Matrix sentence test while gait metrics were captured with the APDM Mobility Lab system. Tasks included SRT in quiet (SiQ) and noise (SiN) during sitting and walking. Dual-task costs (DTCs) quantified performance trade-offs. Cognitive testing assessed visual attention, working memory, processing speed, and fluency.

**Results:** YA outperformed OA in SiQ and SiN. Both groups showed reduced performance during DT, with YA maintaining a 5.5 dB SNR advantage. OA exhibited greater gait metric reductions in SiN compared to SiQ, with significant differences between groups. Lower cognitive scores correlated with poorer performance across tasks.

**Conclusion:** The findings highlight the cognitive demands of DT scenarios for OA, emphasizing the need for targeted rehabilitation to address MCI and improve real-life functional outcomes.

## MUSIC THERAPY FOR CI USERS

OÄ Dr. Astrid Magele<sup>1,2</sup>, **MSc Bianca Wirthner**<sup>1</sup>, Mag. Bsc. Philipp Schörg<sup>1,2</sup>, Prim. Univ.-Prof. Dr. Georg M. Sprinzl<sup>1,2</sup>

<sup>1</sup>University Clinic St. Pölten, St.Pölten, Austria, <sup>2</sup>Karl Landsteiner Institute of Implantable Hearing Devices, St.Pölten, Austria

**Background:** Cochlear implantation (CI) and the accompanying rehabilitation has become a routine procedure in hearing restoration. Literature is sparse on elderly CI recipients focusing on the issue of age and their inclined auditory resolution, taking their diminished cognitive function into account, which requires adaptation of rehabilitation programs to overcome habituation.

**Objective:** 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.

**Conclusions:** 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.

## Poster Pitch Session 4

Poster Area (Garderoobe 1), May 16, 2025, 15:00 - 15:30

### IMPROVING SPEECH UNDERSTANDING IN PATIENTS AFTER COCHLEAR IMPLANTATION AFTER REPLACING THE SPEECH PROCESSOR WITH A NEW ONE

**Prof Jarosław Markowski<sup>1</sup>**, MD, Ph.D. Katarzyna Przytuła-Kandzia<sup>1</sup>, MD, Ph.D. Lucyna Klimczak-Gołąb<sup>1</sup>

<sup>1</sup>Department of Laryngology Faculty of Medical Sciences in Katowice Medical University of Silesia in Katowice, Katowice, Poland

**Backgrounds:** The cochlear implant treatment program was established in our Department in 2004. We have implanted 216 patients aged 4 to 87 years (average age 45) within 15 years. The profound hearing loss and deafness treatment program also includes replacing the speech processor with a new one in the event of its failure and the service life exceeding 5 years at the same time.

**Methods:** At present, we have carried out exchanges with almost 120 patients with implants from various companies. After the exchange, subjective evaluation was carried out as part of surveys assessing the quality of life of patients after replacing the speech processor. Speech understanding in free field in noise was also assessed.

**Results:** The obtained results allow us to state that the patient's quality of life after replacing the speech processor with a new one increases. Speech understanding improves in approximately 70% of patients. Failures are associated with the lack of rehabilitation and sufficient use of the processor by the patient.

**Conclusions:** in our observation, most patients had much better speech understanding after replacing their speech processor with a new one, which had a positive impact on their quality of life and level of satisfaction with cochlear implantation.

# A SCOPING REVIEW OF QUALITATIVE RESEARCH ON COCHLEAR IMPLANTATION OUTCOMES IN ADULTS

**Consultant And Phd Candidate Pia Bergman**<sup>1</sup>, Professor Elina Mäki-Torkko<sup>2</sup>

<sup>1</sup>Ent County Hospital Ryhov, Jönköping, Sweden, <sup>2</sup>Audiological Research Centre , Örebro, Sweden

**Background:** Hearing impairment is a prevalent condition with wide-ranging consequences. While cochlear implantation (CI) outcomes have been extensively studied, qualitative methodologies remain underutilized. However, they are increasingly employed to explore the experiences and perspectives of individuals with hearing impairment. This scoping review synthesizes existing qualitative research on CI outcomes in adults, providing a comprehensive overview of methodologies and findings.

**Methods:** Systematic searches in PubMed, CINAHL, PsycInfo, Cochrane Library, SwePub, and DiVA identified 855 unique records, of which 23 met the inclusion criteria.

**Results:** Four qualitative methodologies were identified, with grounded theory and thematic analysis being the most commonly applied, alongside phenomenological and narrative approaches. Interviews were the primary data collection method, complemented by surveys and open-ended questionnaires. Outcomes were categorized into ten domains, encompassing a broad range of impacts. Beyond improved hearing and communication, benefits included enhanced social interactions, employment-related experiences, music perception, and tinnitus management.

**Conclusions:** Qualitative research offers a rich, patient-centered understanding of CI outcomes, capturing the complex and multifaceted impacts—such as psychosocial well-being, identity, and quality of life—that often elude quantitative studies. By complementing quantitative approaches, qualitative methodologies provide essential insights for clinicians, policymakers, and researchers, enabling a more holistic evaluation of CI outcomes.

## A CASE REPORT OF RIBLOFLAVIN TREATMENT AND COCHLEAR IMPLANTS IN A 4-YEAR-OLD GIRL WITH PROGRESSIVE HEARING LOSS AND DELAYED SPEECH DEVELOPMENT: BROWN-VIALETTO-VAN LAERE SYNDROME

Anna K. Piecuch<sup>1</sup>, **Prof. Piotr Henryk Skarzynski**<sup>2,3</sup>, Prof. Henryk Skarżyński<sup>1</sup>

<sup>1</sup>Otorhinolaryngosurgery Clinic, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany, Poland, <sup>2</sup>Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany, Poland, <sup>3</sup>Institute of Sensory Organs, 05-830 Kajetany/Warsaw, Warsaw, Poland

**Background:** Brown-Vialetto-Van Laere (BVVL) syndrome is a rare autosomal recessive disorder caused by mutations in intestinal riboflavin transporter genes, resulting in a motor neuron disorder of childhood, which can be associated with sensorineural deafness. This report describes a 4-year-old Polish girl with progressive hearing loss and delayed speech development diagnosed with Brown-Vialetto-Van Laere syndrome who was treated with riboflavin (vitamin B2) and cochlear implants.

**Methods:** The case report concerns a girl from Poland who, at the age of 2 years 10 months, developed progressive atypical neurological symptoms of unknown etiology: ataxia of the upper and lower limbs, gait abnormalities, generalized muscle weakness, visual and hearing problems, and regression of speech development. A karyotype study (whole-exome sequencing) revealed alterations within SLC52A2, leading to the diagnosis of Brown-Vialetto-Van Laere syndrome and initiation of high-dose riboflavin treatment.

**Results:** Hearing tests revealed bilateral profound sensorineural hearing loss with auditory neuropathy. Surgical treatment was applied in the form of bilateral cochlear implantation.

**Conclusion:** This report shows the importance of genetic testing in infants who present with atypical symptoms or signs. In this case, the diagnosis of Brown-Vialetto-Van Laere syndrome resulted in timely correction of the genetic riboflavin (vitamin B2) deficiency and improved hearing following the use of cochlear implants.



## TONGUE SENSATIONS AFTER COCHLEAR IMPLANTATION

**Assist. Prof. Md, Phd Nina Božanić Urbančič**<sup>1,2</sup>, MD Dejan Mladenov<sup>1</sup>, prof. MD, PhD Saba Battelino<sup>1,2</sup>

<sup>1</sup>Umc Ljubljana, ENT Clinic, Ljubljana, Slovenia, <sup>2</sup>Univeristy of Ljubljana, Faculty of Medicine, Ljubljana, Slovenia

**Background:** The chorda tympani nerve, a branch of the facial nerve, plays a crucial role in taste sensation and eventually also the somatosensory function of the anterior tongue. Cochlear implant (CI) surgery, due to its proximity to the facial nerve, may influence chorda tympani function. This study investigates tongue two-point discrimination (TPD) as a surrogate marker for chorda tympani function in cochlear implant patients.

**Methods:** This prospective study included adult cochlear implant recipients. Tongue TPD thresholds were assessed using 2 point discriminators in a standardized protocol. Measurements were conducted on the anterior tongue bilaterally post-implantation. Participants were blindfolded to eliminate visual input bias.

**Results:** Postoperative TDP tresholds on both sides of the tongue were measured. The non operated side was considered as control group.

**Conclusion:** Cochlear implantation can affect chorda tympani function, as evidenced by altered tongue two-point discrimination thresholds. TPD assessment provides a simple, non-invasive method to evaluate tongue sensation following CI surgery. Awareness of these changes is important for preoperative counseling and postoperative sensory rehabilitation strategies.

## "PLEASE LOOK TO THE FRONT AGAIN," OR HOW RELEVANT IS THE HEAD POSITION IN DIRECTIONAL HEARING TESTS FOR CHILDREN?

**Elisabeth Zangerl**<sup>1</sup>, Univ. Prof. Simone Graf<sup>1</sup>, Phd Philipp Zelger<sup>1</sup>

<sup>1</sup>Medical University Of Innsbruck, Innsbruck, Austria

**Background:** Hearing loss can impair sound localization, yet no standardized method exists to measure it, particularly in children with or without hearing loss. Current methods assume that, after instructions, patients will orient their head toward the center of the setup. This study examines whether this assumption holds true for children and whether using words versus broadband noise is more suitable for testing directional hearing abilities.

**Methods:** This study included 30 children with bilateral hearing aids and 30 children with normal hearing, aged between 6 and 17 years.

Two sound localization tests were performed using two different types of stimuli: bisyllabic words and broadband noise. Localization performance was quantified using the root mean square angular error (RMS error).

**Results:** Our study revealed that children in both groups exhibited significant deviations of their head position from the center of the setup. This deviation resulted in substantial changes to the localization metrics. Regarding the stimuli, our initial findings suggest that the type of stimulus (bisyllabic words vs. broadband noise) does not significantly affect sound localization performance.

**Conclusion:** A deviation from the center of the setup leads to a significant change of the results of the localization measurements. The error metric may therefore no longer be comparable to patients that do face the center of the setup.

## Free Paper Session 13 - Screening & Diagnostics (Part 3)

Herrensaal, May 16, 2025, 16:45 - 18:15

### GRADED RESPONSE BRACKETING (GraBr) - AN EFFICIENT AND ROBUST PROCEDURE FOR SELF-ADMINISTERED THRESHOLD DETERMINATION

**Prof. Dr. Dr. Birger Kollmeier**<sup>1</sup>, Chen Xu<sup>1</sup>, Dr. Lena Schell-Majoor<sup>1</sup>

<sup>1</sup>Medizinische Physik & Cluster of Excellence Hearing4all, Universität Oldenburg, Oldenburg, Germany

Background: Self-administered audiological tests - e.g. by smartphone - offer an easy access to hearing diagnostics beyond lab tests in the booth. They also enable a larger and more diverse dataset collection than lab studies. However, occasional inattention and environmental disturbances in such self-administered settings can have massive detrimental effects if classical adaptive tests are used [1]. Hence, the robust Graded Response Bracketing (GraBr) procedure was developed based on the method by Lecluyse and Meddis [2].

Method: In each trial, the stimulus is presented twice at different presentation levels that “bracket” the assumed threshold. The participants’ “graded” response indicates if no, one, or two stimuli were perceived. The level difference of the stimuli is changed adaptively with the aim to “narrow the bracket” around the hearing threshold.

Results: The method has been shown to be robust and efficient in simulations and is validated experimentally using the Virtual Hearing Clinic (VHC, [www.virtualhearingclinic.de](http://www.virtualhearingclinic.de)). This contribution will present the method and the current status of the validation study.

Conclusion: We will discuss the benefits of using GraBr and its potential for data-driven audiology.

[1] Xu, C., Huelsmeier, D., Buhl, M., Kollmeier, B. (2024). How does inattention influence the robustness and efficiency of adaptive procedures in the context of psychoacoustic assessments via smartphone? *Trends in Hearing* 28, 1-21.

[2] Lecluyse, W., & Meddis, R. (2009). A simple single-interval adaptive procedure for estimating thresholds in normal and impaired listeners. *The Journal of the Acoustical Society of America*, 126(5), 2570–2579. <https://doi.org/10.1121/1.3238248>

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# LONG-TERM FUNCTIONAL CHANGES IN MASTOID PHYSIOLOGY FOLLOWING MASTOIDECTOMY FOR ACUTE MASTOIDITIS

**Matija Svagan**<sup>1</sup>

<sup>1</sup>University Clinical Center Maribor, ENT, Maribor, Slovenia

**Background:** Despite the widespread use of antibiotics, acute mastoiditis (AM) and related complications resulting from acute purulent otitis media continue to occur, predominantly in children. Although numerous studies have focused on the pathogenesis, aetiological agents, and treatment of AM, comprehensive investigations of the long-term outcomes of AM and the physiological consequences of surgical intervention in the temporal bone are lacking.

**Methods:** A new protocol for non-invasive measurement of mastoid function was developed, using tympanometry and vHIT as main components. Results of children operated with mastoidectomy for AM were compared with a control group

**Results:** Mastoid function testing after mastoidectomy revealed preserved pressure-buffering ability but reduced thermal insulation of the vestibular organ under extreme thermal conditions, which are rare in everyday life.

**Conclusions:** In the long term, most patients recovering from AM exhibit only minor functional and structural sequelae. In the context of AM management, the effects of mastoidectomy are negligible compared to those of less invasive surgical interventions

## LOW FREQUENCY HEARING BELOW 125 Hz. I. CONCEPT AND FINDINGS IN HEALTHY ADULTS.

PhD student, Doctor Jonas Brunn Kjærsgaard<sup>1</sup>, **Associate Professor Rodrigo Ordoñez**<sup>2</sup>

<sup>1</sup>Aalborg University Hospital (Department of Otorhinolaryngology, Head and Neck Surgery), Aalborg, Denmark, <sup>2</sup>Aalborg University (Department of Electronic Systems), Aalborg, Denmark

**Background:** People with severe and profound hearing loss in the mid and high frequency range, above 300 Hz, are generally considered as candidates for Cochlear Implants (CI), due to the little or no benefit obtained with traditional hearing aids. Some of the potential CI recipients have residual low frequency hearing, yet little is known about how residual hearing is affected by the implant or if CI patients benefit from maintaining functional residual low frequency hearing. This study aims to characterize functional low frequency hearing of normal hearing subjects to have a base line for comparison with CI patients.

**Methods:** Low-frequency hearing is characterized by means of pure-tone hearing thresholds at 80, 100 and 125 Hz, as well as supra-threshold sensitivity to spectro-temporal modulation (STM) with low modulation rates, that produce slow temporal changes and narrow frequency variations, as well as fast temporal changes and large frequency fluctuations.

**Results:** 32 normal hearing subjects and 7 presbiacusis patients participated in the study. Hearing thresholds at 80, 100 and 125 Hz as well STM sensitivity at either 80 or 100 Hz were determined.

**Conclusions:** The presented experimental protocol can be used reliably to determine both hearing thresholds and STM sensitivity. Additionally, the results obtained with normal hearing subjects represents the expected performance of the healthy auditory system to discern frequency and temporal modulations, in the low end of the audible spectrum.

## BARRIERS AND FACILITATORS TOWARD A TELEAUDIOLOGY INFANT DIAGNOSTIC TESTING APPROACH IN VICTORIA, AUSTRALIA

**Jocelyn Phillips**<sup>1</sup>, Professor Julia Sarant<sup>1</sup>, Professor Dani Tomlin<sup>1</sup>, Dr. Kelley Graydon<sup>1</sup>

<sup>1</sup>The University Of Melbourne, Department of Audiology and Speech Pathology, Melbourne, Australia

**Background:** Universal newborn hearing screening allows early identification of congenital hearing loss, however, some families face difficulties accessing diagnostic audiology services. This study investigated opinions of families and audiologists regarding a teleaudiology option for infant diagnostic audiology appointments in Victoria, Australia.

**Methods:** Families who attended either in-person or tele-audiology infant diagnostic audiology appointments to comply with 2020 COVID-19 social distancing recommendations in Victoria were sent a questionnaire exploring their experience, and their opinion regarding a proposed ongoing tele-audiology service. Audiologists were then recruited to participate in focus groups to further explore clinician-identified barriers and facilitators regarding a tele-audiology model.

**Results:** No significant differences between the experiences of families from in-person and teleaudiology infant diagnostic audiology appointments were reported, and opinions of a tele-audiology option were largely positive. There were however a small number of families with substantial concerns regarding a telehealth model of infant diagnostic assessments. The key theme from audiologists was a “barrier trade-off”- that tele-audiology had the capacity to reduce barriers to service access for some families, it may introduce additional challenges compared to conventional in-person testing. Three main barriers or areas of concern regarding a tele-audiology model of infant diagnostic services were identified: communication and support concerns, risk of error, and financial and motivational barriers.

**Conclusion:** A tele-audiology model of infant diagnostic assessments in Victoria has the potential to improve accessibility of diagnostic testing in the state if facilitator training, effective family communication and resource management are prioritized to reduce barriers.

## AUDITORY PROCESSING ASSESSMENT USING PSYCHOACOUSTIC AND ELECTROPHYSIOLOGICAL METHODS

Prof. Maria Boboshko<sup>1</sup>, PhD. Ekaterina Garbaruk<sup>1</sup>, PhD. Natalia Maltseva<sup>1</sup>, **PhD. Sofia Vikhnina<sup>1</sup>**, PhD. Oleg Markelov<sup>2</sup>

<sup>1</sup>Pavlov First St. Petersburg State Medical University, Saint-petersburg, Russia, <sup>2</sup>St. Petersburg Electrotechnical University "LETI", St. Petersburg, Russia

**Background:** Speech intelligibility is affected by both elevated hearing thresholds and suprathreshold processing deficits (neural impairments and auditory processing disorders, APD). Primary APD assessment is based on psychoacoustic testing. The study is aimed to investigate whether there are any differences of cortical auditory evoked potentials (CAEPs) recorded in patients with and without APD.

**Methods:** 26 adults with permanent sensorineural hearing loss ranging from mild to moderately severe were examined. All the patients underwent the audiological evaluation, psychoacoustic testing for APD, Montreal Cognitive Assessment, and tone-evoked CAEPs. The correlation analysis and the mathematical framework of Bayesian networks were carried out.

**Results:** According to the psychoacoustic testing results, all the patients were divided into subgroups with and without APD. CAEPs were identified in all subjects. Correlation analysis revealed a direct correlation between the presence of APD with both factors: the age ( $r=0.47$ ), and the CAEPs morphology and test-retest reliability ( $r=0.76$ ,  $p=0.05$ ). For APD prediction, a Bayesian network model based on the CAEPs characteristics with a relatively high Pearson correlation between predicted and observed values ( $R=0.66$ ) was constructed.

**Conclusion:** No direct correlations have been identified between individual characteristics of CAEPs and the psychoacoustic tests results. However, when these characteristics were combined into a comprehensive model, an overall integral effect was observed. The predictive ability for APD using a complex model based on a Bayesian network was statistically approved. The study limitations were the small sample size and not a speech-evoked, but a tone-evoked CAEPs use.

## A GAME-BASED HEARING SCREENING FOR IDENTIFYING HEARING LOSS IN CHILDREN 4-13 YEARS OF AGE.

**Dr. Kelley Graydon**<sup>1</sup>, Mr Patrick Bowers<sup>1</sup>, Professor Gary Rance<sup>1</sup>  
<sup>1</sup>1, Melbourne, Australia

**Background:** To evaluate the effectiveness of a tablet-based hearing screening game for primary school-aged children. To examine the prevalence of middle and outer ear issues, hearing loss and spatial processing disorders among primary school-aged children.

**Methods:** The automated hearing test was used as a screening tool (1256 children tested), measuring hearing abnormalities through speech-in-quiet/noise and tone-in-noise. Children who failed the screenings underwent follow up testing with pure tone audiometry, tympanometry, otoscopy, and speech in noise testing. Results of each test were compared to measure efficacy.

**Results:** 111 children (8.84%) showed evidence of middle/outer ear issues. 21 children (1.67%) had hearing loss in at least one ear. 30 children (2.52%) were diagnosed with difficulties listening in noise. The false positive rate was 5.01%, indicating a relatively small proportion of children who failed the screenings actually had normal hearing.

**Conclusion:** A game-based program testing sound detection and binaural speech processing can effectively detect undiagnosed hearing deficits in large-scale school hearing screenings. The study also established the prevalence of hearing abnormalities among school aged children in Victoria, Australia, highlighting the value of school hearing screening programs.



## Free Paper Session 14 - Complex Auditory Disorders

Prälatensaal, May 16, 2025, 16:45 - 18:15

### AUDIOLOGICAL ASPECTS OF REHABILITATION AFTER COCHLEAR IMPLANTATION IN PATIENTS WITH INNER EAR MALFORMATIONS

**Phd Denis Kaliapin**<sup>1</sup>, PhD Sefafima Sugarova<sup>1</sup>, PhD Andrei Lilenko<sup>1</sup>, PhD Dmitriy Kliachko<sup>1</sup>

<sup>1</sup>St. Petersburg Scientific Research Institute Of Ear, Throat, Nose And Speech, Saint-Petersburg, Russia

**Background:** The study is devoted to the rehabilitation stage of cochlear implantation in patients with inner ear malformations. It provides a detailed analysis of the audiological characteristics and draws conclusions about approaches to interpreting diagnostic data and speech processors fitting.

**Materials and methods:** track records of 80 patients with inner ear abnormalities were retrospectively studied, of which 10 had auditory nerve dysplasia. At the surgical and rehabilitation stages, patients underwent analysis of the implant telemetry, neural response telemetry, speech processor fitting maps, and the results of subjective audiological testing. The results were compared with control group of 50 patients with normal inner ear anatomy and congenital deafness etiology.

**Results:** figures of the implant telemetry in patients with malformations of the inner ear and normal anatomy did not significantly differ statistically ( $T = 0.86$ ,  $p > 0.05$ ). The ability to register the eCAP turned out to be significantly lower in patients with cochlear malformations and had a correlation with the degree of pathological development ( $T = 10.2$ ;  $p < 0.05$ ). The distinctive features of the fitting maps of speech processors in different groups were also revealed, as well as the results of audiological testing.

**Conclusions:** patients with abnormalities in the development of the inner ear have distinctive electrophysiological characteristics that are important during the rehabilitation stage of cochlear transplantation. When configuring speech processors, it makes sense to resort to using CIS coding strategies, reducing the dynamic range by increasing the minimum stimulation threshold, and increasing compression.

## THE USE OF BONE-CONDUCTION IMPLANTS IN PATIENTS WITH RARE GENETIC SYNDROMES ASSOCIATED WITH EAR MALFORMATIONS

**Prof. Piotr Skarzynski**<sup>1</sup>, PhD Katarzyna Beata Cywka<sup>1</sup>, Emilia Czaplicka<sup>1</sup>, Prof. Henryk Skarzynski<sup>1</sup>  
<sup>1</sup>World Hearing Center, Institute Of Physiology And Pathology Of Hearing, Kajejetany, Warsaw, Poland, <sup>2</sup>Institute of Sensory Organs, Kajetany, Poland

**Background:** To evaluate the effectiveness and safety of bone-conduction implants in patients with rare genetic syndromes, presenting with ear malformations and associated conductive or mixed hearing loss.

The study included 9 patients diagnosed with rare genetic syndromes, including Treacher-Collins, Goldenhar, Klippel-Feil, Charge syndromes and Mandibulofacial Dysostosis with Microcephaly, who exhibited conductive or mixed hearing loss due to external and/or middle ear malformations.

**Methods:** Bone-conduction implants were surgically implanted in patients with ear malformations who were not candidates for traditional hearing aids due to anatomical constraints.

**Main Outcome Measures:** Hearing improvement was evaluated using pure-tone audiometry and speech audiometry. Subjective satisfaction with the implants was assessed using the Abbreviated Profile of Hearing Aid Benefit (APHAB) questionnaire.

**Results:** All patients showed significant improvement in hearing and speech recognition after the implantation of bone-conduction devices. Pure-tone audiometry and speech audiometry results demonstrated a marked improvement in both quiet and noisy environments. Patients reported a high level of satisfaction, with notable improvements in daily communication. The surgical procedures were safe, with a low incidence of minor complications.

**Conclusions:** Bone-conduction implants are an effective and safe solution for managing hearing loss in patients with rare genetic syndromes associated with ear malformations. Early intervention with these implants supports auditory rehabilitation and improves quality of life, enabling better speech development, especially in children.

The study was approved by Bioethics Committee of the Institute of Physiology and Pathology of Hearing (KB.IFPS/7/2020).

# SPEECH PERCEPTION WITH A VESTIBULO-COCHLEAR IMPLANT: THE IMPACT OF VESTIBULAR CO-STIMULATION IN STATIC AND DYNAMIC SETTINGS

Drs. Benjamin Volpe<sup>1,2</sup>, **Dr. Elke Devocht**<sup>1,2</sup>, Drs. Bernd Vermorcken<sup>1,2</sup>, Drs. Stan van Boxel<sup>1,2</sup>, Dr. Joke Debruyne<sup>1,2</sup>, Dr. Angelica Perez-Fornos<sup>3</sup>, Dr. Nils Guinand<sup>3</sup>, Prof. Dr. Dr. Raymond van de Berg<sup>1,2</sup>

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**Background:** A multichannel vestibulo-cochlear implant (VCI) restores both auditory and vestibular function in patients with bilateral vestibulopathy (BV) and severe sensorineural hearing loss (SNHL). The device integrates nine electrodes in the cochlea (CI) and one in each of the three semicircular canals (VI). Combining these functions can present challenges. Adjustments to the CI stimulation pattern are needed to accommodate vestibular pulses, and simultaneous stimulation may cause current spread between the auditory and vestibular systems. This study evaluated the impact of vestibular co-stimulation on auditory performance with the VCI.

**Methods:** Nine patients with BV and severe SNHL were implanted with a multichannel VCI and underwent CI rehabilitation. Speech perception was evaluated using word recognition in quiet (Consonant-Nucleus-Consonant) and number recognition in noise (Digits-In-Noise). The standard CI processor was compared to the experimental audio-motion processor (AMP). Subsequently, tests were conducted with continuous and motion-modulated vestibular co-stimulation in static and dynamic conditions using the AMP on a hydraulic platform.

**Results:** Speech perception outcomes in these VCI subjects presented similar to those of standard CI users. No significant differences were observed between the CI and AMP processors or across static and dynamic conditions. Vestibular co-stimulation, whether baseline or modulated, did not negatively affect speech perception.

**Conclusion:** These findings indicate that vestibular co-stimulation does not affect functional speech perception in VCI subjects, even under motion-modulated dynamic conditions. The study highlights the feasibility of VCI technology as a rehabilitative option for patients with combined auditory and vestibular deficits. Further refinement and long-term evaluation are needed to assess its full potential.

## LIVING WITH COMBINED VISION AND HEARING LOSS: WHAT DIFFERENCE DOES THE HEARING MAKE?

**Phd Student Jenny Widmark<sup>1</sup>**, PhD Milijana Malmberg, Phd Sarah Granberg

<sup>1</sup>University of Gothenburg, Gothenburg, Sweden

**Background:** Usher syndrome type 2 is characterized by congenital hearing loss and progressive visual impairment, typically emerging during adolescence. Previous research highlights challenges in information access, communication, orientation, mobility, and psychosocial well-being for individuals with combined vision and hearing loss.

**Purpose:** This study explored how people with Usher type 2 experience hearing, hearing aids, and assistive technologies in daily life.

**Method:** Eight individuals with Usher type 2, averaging 57 years old, participated in semi-structured interviews with open-ended questions. Data were analyzed using inductive qualitative content analysis.

**Results:** Four key areas emerged: information, communication, orientation and mobility, and psychosocial aspects. Progressive vision loss increases challenges in spoken communication due to difficulties in lip reading and observing facial expressions. Hearing aids are essential for communication and accessing information through hearing when vision is insufficient. However, using hearing aids and assistive devices requires skill, training, and is energy-intensive, making rest periods necessary. Environmental factors, such as lighting and sound conditions, significantly affect functionality. Hearing aids enhance orientation, mobility, and a sense of control and security. From a psychosocial perspective, hearing aids play a vital role in fostering social interaction, and individuals adopt strategies to manage daily life effectively.

**Conclusion:** Hearing aids and assistive devices are crucial for individuals with Usher type 2, but reliance on technology introduces vulnerabilities if it fails. Environmental factors heavily influence success in information access, communication, and mobility. Strategies to conserve energy are essential for managing daily activities.

## EXPLORING THE ROLE OF HEARING IN NAVIGATING THE DIGITAL WORLD FOR INDIVIDUALS WITH DEAFBLINDNESS

**Phd Student Jenny Widmark**<sup>1</sup>, PhD Milijana Malmberg, Phd Sarah Granberg, Professor Elina Mäki-Torkko

<sup>1</sup>School of Health Sciences, Örebro University, Örebro, Sweden

**Background:** Deaf-blindness is a complex condition characterized by a combination of hearing and vision loss, varying in severity which significantly impacts communication, information access, and mobility. The dual sensory loss creates unique challenges. In today's digitized world, technology is crucial for inclusivity. The United Nation highlights the need for a sustainable, inclusive society, ensuring no one is left behind in the digital evolution. For individuals with deaf-blindness, tailored strategies and technological solutions like hearing aids, cochlear implants, smartphones, and screen readers are crucial for digital participation. Research on how this population uses hearing and these tools is limited.

**This study explores** the technological and support needs of individuals with deaf-blindness to enhance their digital participation. It examines how they use hearing, hearing aids, and digital tools to manage daily online interactions and integrate into society.

**Method:** A qualitative, inductive exploratory approach is used, complemented by semi-structured interviews with 10–15 Swedish participants aged 18 or older, with acquired deaf-blindness, hearing aids- or cochlear implant users. Data is analyzed using qualitative content analysis.

**Results:** Data collection and analysis are undergoing, with preliminary findings to be presented at the EFAS conference.

**Conclusion:** Initial results will shed light on the lived experiences of individuals with deaf-blindness in what significance, if any, using hearing aids and other technological aids plays a role in navigating the digital world. The study underscores the lack of research and clinical competence in this area, highlighting the critical need for targeted technological support to ensure no one is left behind in the digital transformation.

## SUPRATHRESHOLD PROCESSING SKILLS IN TRAUMATIC BRAIN INJURY

**Lecturer Sevgi Kadihanoglu**<sup>1</sup>, Research Assistant Yagmur UNAL<sup>2</sup>, Professor Meral Didem Turkyilmaz<sup>3</sup>

<sup>1</sup>Department Of Audiometry, Kutahya Health Sciences Universtiy, Kutahya, Türkiye, <sup>2</sup>Department of Audiology, Istanbul Medeniyet University, Istanbul, Türkiye, <sup>3</sup>Department of Audiology, Hacettepe University, Ankara, Türkiye

**Background:** In traumatic brain injury (TBI), primary lesions that can affect neurons responsible for hearing occur, which can cause inadequate central processing problems involving cortical and subcortical auditory areas. When we look at the literature, studies on the evaluation of central processing with behavioral tests are limited. In this study, the suprathreshold processing skills of a patient with a history of traumatic brain injury were investigated due to her complaint of difficulty understanding speech in noise or in quiet environments.

**Methods:** In order to investigate the patient's suprathreshold processing skills, "Test of Attention in Listening-TAİL" and "Turkish Matrix Test" were applied.

**Results:** According to the patient's first hearing test result, normal hearing was detected on the left and moderate sensorineural hearing loss on the right. Hearing tests performed every two years showed that the results in both ears didn't change. Test of Attention in Listening-TAİL results showed that the patient had a lack of attention skills and a weakness in auditory memory. The average intelligibility percentage in the Turkish Matrix Test was obtained as 62%.

**Conclusion:** In individuals with a history of TBI, even if there is no hearing loss or temporal bone fracture, problems may occur in many situations such as central auditory processing, auditory memory, and auditory attention. Therefore, the peripheral auditory system of such cases should be evaluated in detail and appropriate diagnostic suprathreshold tests should be applied. Individuals with detected problems should be provided with appropriate therapy or educational support as soon as possible.

## ADHEAR VS PASSIVE TRANSCUTANEOUS BONE-CONDUCTION IMPLANT IN PEDIATRIC CONGENITAL AURAL ATRESIA

**Ph.d Maria Fernanda Pedrero Escalas<sup>1</sup>**, MD. Rosa María Pérez Mora<sup>1</sup>, Md. Laura Caballé<sup>2</sup>, Md. Carlos de Paula Vernetta<sup>2</sup>, Ph.D Luis Lassaletta Atienza<sup>1</sup>, Ph.D Javier Gavilán Bouza<sup>1</sup>

<sup>1</sup>OTOLARYNOLARINGOLOGY, Madrid, Spain, <sup>2</sup>OTORYNOLARINGOLOGY, Valencia, Spain

**Background:** In 2017, the non-implantable bone conduction device (Adhear Med-EI) was created. The aim of our study is to compare the auditory outcomes and patient satisfaction between ADHEAR and the passive transcutaneous bone-conduction implants (BCImplant).

**Methods:** We included 16 pediatric patients with bone conduction threshold  $\leq 25$ dB who were users of BCImplants (Attract 5 or 4, Sophono) for at least one year, and gave them ADHEAR for one week. After this, pure tone thresholds and word recognition with bisyllables at 65dB with and without noise were measured for each of the two devices.

Finally, the ADHEAR specific satisfaction questionnaire, SSQ life questionnaire and the Kinddle quality of life questionnaire were passed.

**Results:** The age of the patients was between 5 and 16 years. All of them with congenital aural atresia, 9 unilateral and 7 bilateral.

The pure tone average in the studied ear recorded a mean threshold of 52 dB unaided. The mean BCImplant-aided threshold was 27 dB and 29 dB ADHEAR-aided. The average word recognition score was 96% for the BCImplant and 95% for the ADHEAR in quiet. The word recognition score in noise at 5 dB SNR was 70% for the BCImplant and 77% with ADHEAR and at 0 dB SNR 50% for the BAHA and 48% with ADHEAR.

**Conclusion:** The new ADHEAR provides comparable auditory results as passive transcutaneous bone-conduction implants in free field, in word discrimination in quiet, and word recognition with background noise. The overall satisfaction of the new ADHEAR device is good.

## Free Paper Session 15 - Innovative Technologies / Therapies

Room Hartmann, May 16, 2025, 16:45 - 18:15

### EARLY ACTIVATION OF COCHLEAR IMPLANT WITH CONSECUTIVE HEARING REHABILITATION

**Dr. Philipp Glocknitzer**<sup>1</sup>, Univ.-Prof. Dr. Georg M. Sprinzl<sup>1</sup>, PD Dr. MBA Astrid Magele<sup>1</sup>

<sup>1</sup>Department of Otorhinolaryngology Head and Neck Surgery, St. Pölten, Austria

**Background:** The cochlear implant is a neural prosthesis and has been the gold standard treatment for severe to profound sensorineural hearing loss for several decades. This study aims to compare the outcomes of early cochlear implant (CI) activation, performed during the same hospital stay as the surgery, with the standard activation schedule, which typically occurs several weeks post-surgery.

**Methods:** Patients with Single Sided Deafness, Measurement of Speech recognition and Pure Tone Audiometry

**Results:** The study is still ongoing, the results so far show a better integration and well-being of the patients 6 months postoperatively.

**Conclusion:** So far the study shows a better postoperative outcome in speech recognition



# INVESTIGATION OF TRANSCUTANEOUS AURICULAR VAGAL NERVE STIMULATION AFFECTS AUDITORY PROCESSING ABILITIES IN HEALTHY INDIVIDUALS

**Audiologist, M.sc. Ayberk Aydin Tunc**<sup>1</sup>, Associate Proffesor Oguz Yilmaz<sup>1</sup>

<sup>1</sup>Istanbul Medipol University, Istanbul, Türkiye

**Background:** Central auditory processing (CAP) is detailed analysis of sound, starting from the inner ear, in the auditory pathways and relevant areas in the cortex. Research shows that CAP can be assessed with special tests such as the Frequency Pattern Test (FPT) and the Duration Pattern Test (DPT). The fact that behavioral effects of vagus nerve stimulation (VNS) have been demonstrated in the literature and the activation of transcutaneous auricular VNS (taVNS) in the auditory cortex has been observed in f-MRG studies. The aim of this study is to investigate whether taVNS usage, which has not been investigated in central auditory processing studies before, has effects on central auditory processing.

**Methods:** In this study, 70 normal-hearing participants were divided into a control group (n=30) and a study group (n=40) who received taVNS. Both groups completed FPT and DPT assessments before and immediately after the application.

**Results:** The study group showed significant score increases in 8 subcategories ( $p<0.05$ ), while no improvements were noted in 6 parameters for the control group ( $p>0.05$ ).

**Conclusion:** The results show that taVNS application contributes positively to the processing of frequency and duration information, in CAP. At present, several treatment methods are used for central auditory processing disorders. The data we have obtained are preliminary for a therapy method that can be used in this field, and further studies should be carried out in terms of patients and the effects of long-term use.

# DEVELOPMENT OF A WEB-BASED AUDITORY TRAINING PROGRAM: REMOTE MONITORING AND PERFORMANCE EVALUATION

**Phd Sevgi Kutlu**<sup>1</sup>, Prof. Dr. Cem Meço<sup>2,3,4</sup>

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Medical University, Salzburg, Austria, <sup>4</sup>Department of Otolaryngology, Head and Neck Surgery,

Cornell University, Weill Cornell Medical College, New York, USA

**Background:** This study aimed to design a web-based auditory training program to enhance auditory perception skills in children with hearing loss, enable remote monitoring, and assess its usability and satisfaction levels among families and experts.

**Methods:** The program includes modules on Identification, Discrimination, Recognition, Comprehension, Auditory Memory-Attention-Sequencing, and Phonological Awareness, encompassing 38 sub-games with three difficulty levels and a targeted 70% success rate. Participants included 18 preschoolers, 18 school-age children, their parents, and 10 expert audiologists. Usability was evaluated through two forms addressing five sub-factors: usability, comprehensibility, satisfaction, design, and motivation.

**Results:** Experts rated the program highly positive across all dimensions. Parents rated comprehensibility very positively and other dimensions positively. Performance comparisons showed both age groups achieved a 70% success rate across all difficulty levels in the Identification, Discrimination, Recognition, Comprehension, and Auditory Memory-Attention-Sequencing modules. However, school-age children consistently outperformed preschoolers in many sub-games, with success rates increasing with age. In the Phonological Awareness module, children from both groups achieved 70% success in two sub-sections. Yet, in three sub-games, preschoolers fell below the threshold, while school-age children maintained 70% success across all difficulty levels. Correlation analyses indicated age significantly influenced performance in certain sub-games.

**Conclusion:** Overall, the program demonstrates potential usability for children aged 3–10 years, with clear instructions and adaptability. The web-based auditory training program can serve as a promising supplement to traditional auditory rehabilitation. The remote monitoring feature facilitates the identification of auditory perception stages that present challenges for the child by experts, thereby enabling the organization of an auditory training program.

# RETHINKING HEARING AID FITTING: A QUALITATIVE STUDY OF AUDIOLOGISTS' PERSPECTIVE ON A HEARING HEALTH CARE APP USING ECOLOGICAL MOMENTARY ASSESSMENT

**Josepha Birkel**<sup>1,2</sup>, Dr. Rosa-Linde Fischer<sup>1</sup>, Dr. Nadja Schinkel-Bielefeld<sup>1</sup>

<sup>1</sup>ORCA Labs Europe, Scientific Institute of WS Audiology,, Erlangen, Germany, <sup>2</sup>University of Applied Sciences, Landshut, Germany

**Background:** In traditional hearing aid (HA) fine adjustment processes (FAP), hearing health care professionals (HCPs) use a combination of objective and subjective methods, such as self-reports, to customize the HA to their client's needs. However, compared to assessments conducted through ecological momentary assessment (EMA), these methods are often retrospective and cannot provide detailed insights into specific listening environments, limiting the prediction of real-life outcomes.

**Methods:** The aim of this study was to explore HCPs' perspectives for the functional development of an EMA application (app) that evaluates real-life listening situations of HA users. Seven HCPs (four female) with 6- to 15-plus years of professional experience were interviewed. The transcripts were analyzed via qualitative content analysis according to Mayring and Kuckartz, describing the meaning of the data through a process of coding identifying themes or patterns.

**Results:** Three main categories were identified: (a) The app should allow usage by HA users and communication partners depending on the circumstances, (b) the design should enable quick and easy usage and integration into everyday life, (c) the app should allow clients to self-manage their condition and take active part in the FAP.

**Conclusion:** These findings suggest that the development of an app may help to better involve clients in the FAP and facilitate HCPs understanding of the real-life experiences of their clients. However, further research is needed to fully assess the benefits of such an app.

# IMPLEMENTATION OF CI REHABILITATION AS FOLLOW-UP TREATMENT (FUT): EARLY INPATIENT REHABILITATION

**Univ.-Prof. Dr.-Ing. Uwe Baumann**<sup>1</sup>, Dr. Stefanie Brusckke<sup>1</sup>, Prof. Dr. med. Timo Stöver<sup>1</sup>, Prof. Dr. med. Silke Helbig<sup>1</sup>, Dr. med. Roland Zeh<sup>2</sup>

<sup>1</sup>Goethe-University Frankfurt/Universitätsmedizin/HNO, Frankfurt, Germany, <sup>2</sup>Kaiserberg Median Klinik/Abteilung HTS, Bad Nauheim, Germany

**Background:** Hearing rehabilitation is a critical part of cochlear implant (CI) fitting, significantly improving speech understanding. Previously, CI rehabilitation in Germany required case-by-case funding applications, often resulting in delays. A pilot project demonstrated the safety and feasibility of early inpatient rehabilitation after CI surgery [1]. As a result, CI rehabilitation was integrated into the German follow-up treatment (FUT) catalog on January 1, 2025, allowing patients to begin rehabilitation within two weeks of hospital discharge [2].

**Methods:** In this study, patients in the intervention group (IG, n=189) began rehabilitation within 27 days post-surgery, while the control group (KG, n=20) followed standard procedures, facing longer delays (average 172.5 days).

**Results:** The IG showed significantly faster and greater improvement in speech understanding at the 3-month mark compared to the KG (25 vs. 5 percentage point improvement). At six months, both groups had comparable outcomes, but the shorter wait for rehabilitation allowed IG patients to return to normal life sooner.

**Conclusion:** The findings confirm that early CI rehabilitation as FUT enhances patient care and complements existing rehabilitation practices, with the implanting clinic overseeing initiation after the initial CI fitting.

## Literature

[1] Brusckke S, Zeh R, Baumann U, Helbig S, Stöver T (2024) Frankfurt concept of early inpatient rehabilitation after cochlear implant treatment. HNO 72 (Suppl 2), 67–77 (2024).

<https://doi.org/10.1007/s00106-024-01441-y>

[2] Deutsche Rentenversicherung Bund (ed.) (2025) Medical requirements for follow-up rehabilitation (AHB). AHB indication catalog. Status 01 /2025. [https://www.deutsche-rentenversicherung-](https://www.deutsche-rentenversicherung.de/SharedDocs/Downloads/DE/Experten/infos_fuer_aerzte/ahb_indikationskatalog.html)

[ahb\\_indikationskatalog.html](https://www.deutsche-rentenversicherung.de/SharedDocs/Downloads/DE/Experten/infos_fuer_aerzte/ahb_indikationskatalog.html)

# FIRST CLINICAL EXPERIENCE WITH AN AUTOMATED INSERTION TOOL FOR COCHLEAR IMPLANTATION

**Clin.Ass.Prof.PD Dr. Astrid Magele**<sup>1,2</sup>, MSc. Philipp Schoerg<sup>1,2</sup>, Thomas Mayr<sup>1</sup>, Dr. Adrian Piec<sup>1</sup>, Professor MD, PhD Georg Sprinzl<sup>1,2</sup>

<sup>1</sup>KL Private University clinic St.Poelten, Department of Otolaryngology, Head&Neck Surgery, St.Pölten, Austria, <sup>2</sup>Karl Landsteiner Institute of Implantable Hearing Devices, , St.Pölten, Austria

**Background:** To preserve residual hearing during cochlear implantation, it is necessary, among other things, to insert the electrode gently and slowly. The automated insertion tool OTODRIVE (MED-EL GmbH, Austria) enables a slow, even movement of the forceps at a predetermined speed and should thus facilitate gentle electrode insertion.

The aim of the present study is to gain initial experience with the automated insertion tool regarding surgical handling and to investigate any influence on residual hearing retention.

**Material/Methods:** Patients who were routinely fitted with a cochlear implant between September 2024 and March 2025 and inserted with the automated insertion tool will be included in the evaluation. In the case of existing pre-operative residual hearing, the extent to which this can be preserved during the operation will be investigated. In addition, parameters such as complication rate, duration of insertion and final insertion depth are documented.

**Results:** The initial results show a complication-free electrode insertion and a mean postoperative bone conduction hearing loss of approx. 11 dB HL. The average time for electrode insertion is about 4 minutes, whereby a minimum insertion speed of 0.1 mm/s can be achieved.

**Conclusion:** Initial clinical experience with the OTODRIVE automated insertion tool shows that it is easy to use during surgery, although there is a certain learning curve to overcome. Automated insertion has the potential to enable good residual hearing retention.

## Poster Pitch Session 5

Poster Area (Garderober 1), May 17, 2025, 10:00 - 10:35

### CALIBRATION OF THE ARTIFICIAL MASTOID IN THE HIGH FREQUENCIES

**Ir. Máire van der Tak**<sup>1</sup>, Dr. Karl-Johan Fredén Jansson<sup>2</sup>, Dr. Koenraad Sjoerd Rhebergen<sup>1</sup>, Prof. Dr. Bö Håkansson<sup>2</sup>

<sup>1</sup>UMC Utrecht, Utrecht, The Netherlands, <sup>2</sup>Department of Electrical Engineering, Chalmers University of Technology, Göteborg, Sweden

Background: Early detection of hearing damage in children undergoing chemotherapy is crucial. Chemotherapy-related hearing loss often initiates in the high frequencies within the cochlea. To monitor ototoxicity, air conduction (AC) high frequency thresholds can be measured up to 16 kHz. Middle ear problems affect AC thresholds, and thus hamper the determination of high-frequency cochlear loss. Regular diagnostic audiometry includes bone conduction (BC) threshold measurements which is limited to frequencies up to 4 kHz. Measuring BC thresholds at higher frequencies would thus be a relevant addition. A study by Rhebergen (2023) showed that BC thresholds at higher frequencies could reliably be measured.

Currently, there are no norm values for calibration of the BC in the higher frequencies. For this we first need to calibrate the artificial mastoid (AM) for the high frequencies. The force sensitivity (FS) of the AM is fairly stable up until 2 kHz, but deviates in higher frequencies. In this study we will develop a method to calibrate the high frequencies of the AM.

Methods: A measurement system is currently being constructed in order to measure the FS of the AM in the frequency range from 100 Hz to 20 kHz. Repeated measurements will be performed to examine the variation in FS in this range. Furthermore, we will perform a sensitivity study to investigate thermal effects on the calibration method.

Results: Preliminary results show that above 2 kHz there are high deviations in FS.

Conclusion: For calibration of the BC it is essential to correctly calibrate the AM.

# EFFECTS OF LOW FREQUENCY STIMULI ON LATE AUDITORY POTENTIALS

**Mohamad Mahdi Mkanna**<sup>1</sup>, Dr Marion Bug<sup>1</sup>, Dr Stefan Jacob<sup>1,2</sup>

<sup>1</sup>Physikalisch-technische Bundesanstalt, Braunschweig, Germany, <sup>2</sup>Technische Universität Braunschweig, Braunschweig, Germany

**Background:** The growing presence of low frequency noise sources especially in the energy sector has raised concerns about its effects on humans. However, there is still no consensus on how low-frequency sounds, particularly infrasound, impact human sensory processing. This study aims to explore how low frequencies affect Late Auditory Evoked Potentials (LAEPs) N1, P2 and N2, which are commonly used to assess hearing cognitive processes.

**Methods:** We used Electroencephalography (EEG) measurements to record brain activity with 32 electrodes during burst-shaped low-frequency exposure. The common problem to excite clean low-frequency stimuli was solved by using specialized headphones that were developed to create undistorted signals with known SPL at frequencies as low as 2 Hz. Measurements were performed for frequencies starting from 1 kHz reaching infrasound.

**Results:** We present LAEP measurements for multiple frequencies both, in the well audible and infrasound range. The direct comparison of those results shows that low-frequency exposure elicits LAEP, with delayed latencies and reduced amplitudes compared to normal hearing frequencies. We furthermore highlight the complexity of measuring evoked potentials as the hyperparameters chosen for low-frequency exposure such as stimuli duration, onset difference, and repetitions can significantly affect the outcome. We therefore present a systematic assessment of those parameters.

**Conclusion:** This research provides important insights into LAEP for low-frequency stimuli, measured under well-controlled laboratory conditions. The change in latency and amplitude, as well as the increased sensitivity to the hyperparameters indicate that low frequency sounds take more time for processing in the auditory pathway.

# INFLUENCE OF STIMULUS DURATION ON EVALUATING THE UNPLEASANTNESS OF LOW-FREQUENCY SOUNDS

Melina Strüp<sup>1</sup>, Sven Vollbort<sup>1</sup>, Dr Thomas Fedtke<sup>1</sup>, **Dr Marion Bug<sup>1</sup>**

<sup>1</sup>Physikalisch-technische Bundesanstalt, Department 1.6 Sound, Braunschweig, Germany

**Background:** Technological developments are leading to an increase in the population's exposure to low-frequency sound. In a planned study to assess the unpleasantness of low-frequency sounds, stimuli that are as short as possible should be used. Published results showed no influence of durations between 10 s and 40 s (Schäffer et al. 2016) or between 1 min and 5 min (Poulsen 1991) on the annoyance. However, no data are available for stimulus durations below 10 s. Therefore, we investigated this influence on unpleasantness for durations in this range.

**Methods:** A categorical scaling procedure was used to assess the unpleasantness of 24 different stimuli with low-frequency components. All stimuli contained pink noise, which was presented alone, in combination with amplitude-modulated noise or with pure tones of the same level. The measurement was carried out with stimulus durations between 2 s and 32 s.

**Results:** The assessment of unpleasantness was not dependent on the stimulus duration. The unpleasantness of the different sounds and the effect of the low- and high-frequency components are discussed.

**Conclusions:** We assume that independence of stimulus duration was obtained by preconditioning the subjects, as they were asked to rate the unpleasantness of all stimuli independently of each other, assuming that they were present for several minutes.

## References:

T Poulsen (1991). J Sound Vibr 145: 217.

B Schäffer, S J Schlittmeier, R Pieren, K Heutschi, M Brink, R Graf, J Hellbrück (2016). J Acoust Soc Am 139: 2949.



# IMPACT OF CISPLATIN-INDUCED HEARING LOSS ON HEALTH-RELATED QUALITY OF LIFE: A PROSPECTIVE COHORT STUDY

**Professor Lebogang Ramma<sup>1</sup>**, Mr Zenzo Chakara<sup>1</sup>

<sup>1</sup>University of Cape Town, Cape Town, South Africa

**Background:** Cancer claims approximately 8.2 million lives worldwide and this number is set to double to 17.5 million by 2050. In South Africa the lifetime risk of cancer is estimated to be 1 in 8 among males and about 1 in 9 females. Cisplatin, a common chemotherapy drug used for treatment of various types of cancer, is associated with many adverse effects, including hearing loss. This study aimed to determine the impact of cisplatin-induced hearing loss on health-related quality (HRQoL) of life in patients undergoing cancer treatment.

**Methods:** A prospective cohort design was used to follow-up patients undergoing high dose cisplatin chemotherapy at Groote School Hospital, Cape Town, South Africa. Patients' hearing thresholds were prospectively monitored using pure tone audiometry (0.25 to 8 KHz) and HRQoL was assessed using both the Short Form – 36 (SF-36) and the Abbreviated Profile for hearing aid benefit (APHAB) questionnaires. Descriptive and inferential statistics were used to analyse the data.

**Results:** A significant decline in hearing thresholds was correlated with a decline in role-physical ( $p = 0.006$ ) vitality ( $p = 0.011$ ) and social functioning ( $p = 0.016$ ) domains scores post-treatment. A significant decline in hearing was also significantly correlated to significant difficulty with ease of communication sub-scale of the APHAB ( $p = 0.046$ ) and with increased challenges in reverberation post-treatment ( $p = 0.022$ ).

**Conclusion:** Decline in pure tone hearing thresholds was significantly associated with a decline in health-related quality of life.

## EFFECTIVENESS OF THE ADHEAR BONE CONDUCTION DEVICE FITTED BILATERALLY IN A CHILD WITH CONDUCTIVE HEARING LOSS: CASE STUDY

PhD Katarzyna Beata Cywka<sup>1</sup>, **Prof. Piotr Skarzynski**<sup>1,2</sup>

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<sup>2</sup>Institute of Sensory Organs, Kajetany, Poland

**Background:** Frequently, bone conduction hearing aids on a softband are not tolerated by children due to pressure on the head or visual esthetics. By way of contrast, a non-surgical hearing system – Adhear (Med-El, Innsbruck, Austria) – allows the sound processor to be attached using a noninvasive adhesive adapter. The objective of this study was to evaluate the effectiveness of the Adhear system and assess its subjective benefits in a child who had bilateral conductive hearing loss.

**Case report:** The Adhear system was tested in a 13-year-old child with bilateral conductive hearing loss. Pure tone audiometry and speech audiometry in quiet were performed without and then with a pair of devices placed bilaterally. Word recognition scores (WRS) at 50 and 65 dB SPL in quiet were measured using the Pruszewicz monosyllabic Polish word test. After 4 weeks, subjective hearing benefit and experience with the Adhear system was done using the APHAB (Abbreviated Profile of Hearing Aid Benefit) questionnaire.

**Results:** With Adhear, WRS at 50 dB SPL increased significantly from an unaided score of 10% to 80%. The result of free-field audiometry with Adhear on both sides indicated a hearing level within the normal range.

**Conclusions:** Adhear is an effective rehabilitation option for children with bilateral conductive hearing loss.

# UNLOCKING AUDITORY INSIGHTS: VALIDATING THE GREEK PEACH QUESTIONNAIRE FOR YOUNG GREEK AND GREEK-CYPRIOI CHILDREN

**Senior Lecturer PhD Paris Binos**<sup>1</sup>, Research Scientist Georgios Stavrinou<sup>2</sup>, Senior Lecturer PhD Loukia Taxitari<sup>3,1</sup>

<sup>1</sup>CIRCLE Laboratory, Cyprus University of Technology, Limassol, Cyprus, <sup>2</sup>Department of Educational Sciences, European University Cyprus, Nicosia, Cyprus, <sup>3</sup>Department of Psychology, University of Neapolis-Paphos, Paphos, Cyprus

**Objectives:** This study aimed to adapt and validate the Greek version of the Parents' Evaluation of Aural/Oral Performance of Children (PEACH) questionnaire for first time ever with Greek-speaking children aged 1 to 6 years.

**Design:** A cross-sectional study was conducted with 87 children, including 38 from Greece and 49 from Cyprus. All participants were from monolingual Greek-speaking households, with Greek as their first language. The children, aged 12 to 82 months, were reported to have typical hearing, full-term births, and no cognitive, language, or neural deficits. PEACH Overall Scores were compared using an independent samples t-test, and internal consistency was assessed via Cronbach's alpha and item-total correlations. Additionally, regression models were employed to evaluate age-related trends in auditory performance for each group.

**Results:** The Greek-Cypriot sample had significantly higher PEACH Overall Scores (92.09%) than the Greek sample (86.71%),  $t(85) = 2.31$ ,  $p = 0.023$ , suggesting auditory performance differences. Reliability analysis showed strong internal consistency for the Greek sample (Cronbach's alpha = 0.92; item-total correlations: 0.53–0.89) but more variable reliability for the Greek-Cypriot sample (Cronbach's alpha = 0.79; item-total correlations: 0.16–0.75). The Greek sample showed rapid auditory development until 40 months, stabilizing by 60 months, while the Greek-Cypriot sample demonstrated earlier gains until 25 months, flattening by 40 months.

**Conclusions:** The Greek-translated PEACH questionnaire demonstrated robust reliability and validity for the Greek sample. However, the Greek-Cypriot sample exhibited lower reliability and distinct developmental patterns, suggesting potential linguistic or cultural influences on auditory performance. Consider regional differences and refine tools for Greek-speaking populations.

## AUDITORY NEUROPATHY AS A NEW ETIOLOGIC FACTOR IN DELAYED SPEECH DEVELOPMENT

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**Background:** Auditory neuropathy (AN) where sound normally enters the inner but it is disrupted when it travels to the brain. Outer hair cell function is normal, while the inner hair cell / VIII nerve functional unit is abnormal. Children do not develop speech or have delayed speech development. The aim of study was to examine the etiological factors for the development of this disease in our population of these children.

**Methods:** We have studied forty one children pediatric patients having delayed speech or a history of intensive care hospitalisation after birth. Each subject had auditory brainstem evoked response (ABR) and click-evoked otoacoustic emissions (OAE). Etiologic factors were evaluated.

**Results:** All forty one subjects had normal otoacoustic emissions, but abnormalities in brainstem auditory evoked potentials. Important etiological factors were pointed out such as premature birth, hypoxia during pregnancy or childbirth, hyperbilirubinemia, genetic factors. All these findings revealed a state of normal functioning in cochlear outer hair cell function and assessed the lesion at the eighth nerve or / and in the inner hair cell.

**Conclusion:** The differentiation between neural deafness and sensory one is possible by using ABR testing. We must be aware of the possibility of AN in everyday clinical practice because its treatment differs from sensory neural hearing loss. From sensory deafness possible. Otolaryngologists should be aware of this difference and implications for its management, which differs from treatment of sensorineural hearing loss. When the disease is overlooked, a significant speech delay can occur in the child.

## EXPERIENCE OF PSYCHOLOGICAL EVALUATION OF ADULTS IN A COCHLEAR IMPLANT RECIPIENTS

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**Background:** The effectiveness of cochlear implantation surgery is influenced by numerous factors. In addition to post-operative auditory rehabilitation, various pre-surgical assessments are closely linked to and correlated with the outcomes of cochlear implantation. According to previous studies, an individual's mental status is considered one of the possible factors that affect outcomes. It not only influences the post-operative learning perseverance with the cochlear implant but also affects speech recognition results. This study aims to explore whether there is a correlation between our team's experience with adult cochlear implantation cases and the psychological assessment results of the patients prior to surgery.

**Methods:** All the subjects aged from 16 to 66 years were included pre-op mental assessments(Wechsler Adult Intelligence Scale (WAIS)), and some cases also underwent the House-Tree-Person (HTP) projection drawing test. Post-operative outcomes were analyzed, including regular follow-up evaluations of speech recognition (using MMRT), hearing aid/cochlear implant benefit scales, and subjective auditory quality perception questionnaires.

**Results:** The results from the House-Tree-Person test showed that due to the hearing impairment, most individuals exhibited interpersonal tendencies such as insecurity, escapism, or repression. In the 6-month post-operative follow-up, higher pre-surgical verbal IQ percentiles were associated with a greater improvement in speech recognition performance on the MMRT monosyllabic word recognition test. However, there was no significant correlation observed between pre-surgical mental assessment results and post-operative hearing aid/cochlear implant benefit scales or subjective auditory quality perception questionnaires.

**Conclusion:** Besides hearing assessments, imaging and genetic tests, mental evaluation is also needed to be considered before cochlear implant surgery.

## IMPLICATION OF PERSONALIZED MEDICINE VIA ANATOMY-BASED FREQUENCY FITTING OF COCHLEAR IMPLANTED PATIENTS: AN AUDIOLOGICAL VIEW AND PERSPECTIVES

**Max Schlögel**<sup>1,2</sup>, Mag. Bsc. Bianca Wirthner<sup>1</sup>, OÄ Dr. Astrid Magele<sup>1,2</sup>, Prim. Univ.-Prof. Dr. Georg M. Sprinzl<sup>1,2</sup>

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**Background:** In the 21st century, medicine in total is rapidly moving towards the direction of personalized and individualized treatment options. According to the broad variety of sensorineural hearing loss there are new technologies (due to artificial intelligence) for providing patients with severe to profound inner ear hearing loss with cochlear implants and speech processors on an individually anatomy-based fitting strategy (ABF).

The aim of this study is to evaluate the influence of personalized anatomy-based fitting strategies on the outcome of cochlear implanted (CI) patients regarding audiological aspects like speech recognition, music perception and sound quality in comparison to non ABF fitting procedures.

**Methods:** A cohort of cochlear implanted patients with either single sided deafness or asymmetrical sensorineural hearing loss is included. Two strategies of CI fitting – ABF (according to digital radiological imaging and frequency channel detection) and non ABF (with standardized logarithmic frequency mapping) starting with the initial activation of the cochlear implant system are implemented in two study comparison groups. Outcome in speech recognition (number and CVC monosyllables), music perception tests and questionnaires including sound quality were evaluated 3 months and 6 months post first CI fitting.

Digital radiological imaging was also used for preoperative planning and the decision of CI electrode length.

**Results:** Preliminary evaluation shows comparable audiological results in speech recognition but better outcomes in music perception.

**Conclusion:**

Anatomy-based frequency fitting (ABF) may provide speech and music reception in a more natural way than the common used CI fitting procedures.

# BROADBAND AND CHANNEL-SPECIFIC DELAY COMPENSATION IN BIMODAL CI USERS

**Franz-Ullrich Müller**<sup>1,2</sup>, Sebastian Roth<sup>1,2</sup>, Julian Angermeier<sup>1,3</sup>, Werner Hemmert<sup>2</sup>, Stefan Zirn<sup>1</sup>

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Background: Angermeier et al. (2021) demonstrated that sound localization accuracy in bimodal cochlear implant (CI) and hearing aid (HA) users can be improved by reducing static interaural temporal mismatches through the application of a broadband delay to the CI stimulation. However, the mismatch varies across frequencies, due to frequency-dependent traveling-wave latencies on the HA side. Although some manufacturer filter settings account for these latencies, individual electrode locations and corresponding frequencies have to be considered in order to match the channel-specific delays.

Methods: This study evaluates the effects of broadband and channel-specific delay compensation on sound localization performance in bimodal users. Dedicated CI fitting software features are used to compensate the temporal and frequency mismatch between the two modalities, based on computed tomography (CT) imaging and HA latency measurements.

Results: Preliminary findings indicate that broadband delay compensation yields the main improvement in signed localization bias (SB) and root mean square error (RMSE). However, individual cases show further reductions in SB, when channel-specific delays are provided.

## COCHLEAR IMPLANT IN SINGLE SIDE DEAFNESS: MOTIVATIONS, BENEFITS AND PROBLEMS!

**Maria Peixoto**<sup>1</sup>, AUD Cristina Miranda<sup>1</sup>, AUD Mafalda Bento<sup>1</sup>, MD Victor Correia da Silva<sup>1</sup>

<sup>1</sup>Hospital Cuf Porto, Porto, Portugal

**Background:** Since 2008 cochlear implantation has been used in cases of single sided deafness (SSD) to provide binaural hearing. And current data show that binaural hearing is superior to unilateral hearing particularly with improvements in speech perception in noise, localization, and quality of life.

**Methods:** A retrospective study was performed. Ten patients were included. All subjects had severe to profound unilateral hearing loss in one ear and normal hearing or asymmetrical hearing in the other ear.

Speech understanding in quiet and in noise, localization, and tinnitus severity (with the CI on or off) were measured. Performance was measured with both ears (binaural), the CI ear alone, and the NH ear alone. Tinnitus severity and QoL were measured using questionnaires.

**Results:** All patients presented hearing benefit with the implant. The results were only consistent after 6 month. Most patients showed clinically meaningful improvement in speech perception in noise and in quiet. Sound localization as measured by degrees of error from true location improved statistically significantly after cochlear implantation.

Tinnitus and quality of life also present some improvement in the vast majority of patients.

**Conclusion:** The present data suggest that SSD patients benefit from cochlear implantation. Initial rehabilitation in same case represent a challenging situation however, an improvements in speech recognition in noise, sound source localization, tinnitus, and perceived quality of life in adults with SSD can be expected.



# EVERYDAY EXPERIENCES OF ADOLESCENTS AND YOUNG ADULTS WITH UNILATERAL HEARING LOSS

**Assistant Professor Sandhya Vinay**<sup>1</sup>, Elise Lindberg Alexandersen<sup>1</sup>, Ingrid Sofie Lindberg<sup>1</sup>, Associate Professor Nina Jakhelln Laugen<sup>1</sup>

<sup>1</sup>Norwegian University of Science and Technology, Trondheim, Norway

**Background:** Individuals (young and middle-aged adults) with hearing loss are at a higher risk of developing conditions such as depression, anxiety and having reduced quality of life. However, there is a lack of high-quality research on the consequences of early-onset unilateral hearing loss. The study aimed at gaining a better understanding of how unilateral hearing loss affects the everyday activities of adolescents and young adults.

**Method:** Fourteen adolescents and young adults between the ages of 15 and 30 years participated in semi-structured individual interviews conducted digitally. Unilateral hearing loss in the participants was diagnosed before the age of 6 years. All participants followed ordinary school education. Data were analyzed using thematic analysis.

**Results:** The themes that emerged during the analysis include challenges in everyday activities, transition from childhood to adolescence and young adulthood, participation in group activities, communication strategies, and identity, openness and acceptance.

**Conclusion:** Participants in the study seem to have an acceptance of their hearing loss and acknowledge the challenges they experience in social situations, especially in the presence of background noise and with suboptimal positioning. Hearing loss has affected their identity, self-esteem, and sense of belonging. Social stigma related to hearing loss could be a hinderance to openness. Participants reported that use of communication strategies, strategic placement, activity regulation, openness and taking responsibility of facilitation seem to have a positive effect on their everyday activities. The participants also highlight how their relationship towards their hearing loss has changed while transitioning from childhood to adolescence.

# COMPARATIVE OUTCOMES OF COCHLEAR IMPLANT AND BONEBRIDGE FOR SINGLE-SIDED DEAFNESS

**Doctor Kuan Hua William Chen**<sup>1</sup>

<sup>1</sup>Holistic Hearing Healthcare Center, CMU Hospital, Taiwan, Taipei, Taiwan

## Background:

Single-sided deafness (SSD) significantly impacts auditory perception, communication, and overall quality of life. Cochlear Implants (CI) and Bonebridge (BB) are emerging interventions for restoring auditory functionality. However, their specific roles, benefits, and clinical applications require further investigation to guide effective decision-making.

Methods: SSD cases received CI or BB implantation at our center were enrolled. Comprehensive evaluations were conducted pre- and postoperatively, including pure-tone audiometry, sound-field audiometry, word recognition tests, binaural effect assessments, and subjective benefit questionnaires such as the Hearing Implant Sound Quality Index (HISQUI) and the Speech, Spatial, and Qualities of Hearing Scale (SSQ).

Results: A total of 8 cases were recruited. Of the 7 CI patients, 2 had temporal bone trauma, 2 had cochlear nerve deficiency (CND), 2 had congenital SSD, and 1 had sudden hearing loss. The BB case had microtia. All cases showed much better sound-field performance and word recognition score compared to their results with hearing aids. Those with trauma-induced injuries demonstrated the best word recognition performance, while CND cases had the poorest outcomes. The BB recipient also performed better compared to their performance with bone-conduction hearing aids (BCHA). All cases obtained significant subjective benefit improvement after surgery.

Conclusion: Clinical approaches to managing single-sided deafness (SSD) remain diverse and debated. However, for cases of sensorineural hearing loss, if the auditory deprivation period is short, hearing aid benefits are insufficient, CI surgery is recommended. For cases of conductive hearing loss that cannot be resolved through surgery, where BCHA is effective, BB is considered as a viable solution.

# HOW TO MEASURE BINAURAL HEARING IN A CLINICAL SETTING, TOWARDS A UNIFIED TESTING FRAMEWORK FOR SINGLE-SIDED DEAFNESS (SSD)

**Dr. Martijn Agterberg**<sup>1</sup>, MD PhD Paul Van de Heyning<sup>2</sup>

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**Background:** Percutaneous bone conduction devices (BCDs) are an inferior treatment for single-sided deafness (SSD). Cochlear implants (CIs) have increasingly become a treatment choice. The CI is the only device capable of providing bilateral input to the auditory system, and potentially realizing binaural hearing. We identified 23 studies that were cited >100 times in which sound localization was tested as measure of binaural hearing.

**Methods:** A previous consensus paper by Van de Heyning et al. (2017) provided recommendations for a localization setup using a loudspeaker resolution of 30° based on a theoretical statistical model (Hartmann et al. 1998). This consensus was the guidance for the presented work. We investigated how high-level-evidence could be generated within the limited time available in a clinic setting.

**Results:** When speakers are positioned 20 or 30 degrees apart, the mean absolute error (MAE) for normal hearing subjects is 0 degrees. When speakers are positioned 5 or 10 degrees apart the MAE is 5 degrees. The spatial resolution of the loudspeaker layouts used in the 23 reported studies varies between 7.5° and 45°. According to our calculations with the model and values for normal-hearing localization accuracy ( $\sigma_0$ ) and bias provided by Hartmann et al. (1998), with 18 or more loudspeakers, the resulting RMS error for normal-hearing localization performance no longer depends on the number of loudspeakers.

**Conclusions:** In order to provide high-level-evidence for treatment options loudspeakers should be positioned 10 degrees apart. Presented stimuli should be broadband (100 Hz to 20 kHz) with short duration (150 ms).

## Free Paper Session 17 - Auditory Objective Measures (Part 2)

Prälatensaal, May 15, 2025, 15:35 - 17:05

### METHODS OF MEASURING AUDITORY EVOKED POTENTIALS TO UNRAVEL HEARING DIFFICULTIES IN SCHOOL-AGE CHILDREN

**Pre-Graduate Researcher Julie Kjær Jacobsen**<sup>1</sup>, Professor Tobias Neher, Assistant Professor Lindsey Nadine Van Yper

<sup>1</sup>University of Southern Denmark, Odense, Denmark

**Background:** Detecting interaural time differences (ITD) supports sound localization and speech understanding in daily environments. ITD processing may be compromised in children with early otitis media (OM), despite normal audiograms. Psychoacoustic measures depend on behavior and are influenced by attention. AEPs provide a valuable alternative, especially for young or hard-to-test populations. In this study, we used AEPs to assess ITD sensitivity in school-age children without OM history. In this way, we obtained normative data that can be used to investigate ITD sensitivity in children with such a history.

**Methods:** Sixty normal-hearing children aged 6-12 years with no more than two OM episodes were recruited. The AEP stimulus consisted of an amplitude-modulated bandpass-filtered noise (900-Hz bandwidth, centered at 550-Hz) with an ITD that periodically changed between 0 ms and a fixed ITD (0.2, 0.4, or 0.8-ms). Data analysis focused on neural response patterns elicited by the changes in ITD. EEG analysis was performed using pEEGy.

**Results:** Data collection is currently ongoing. Data from the first nine children demonstrate that robust responses can be obtained. Preliminary analyses indicate that—unlike in adults—the responses in children do not consistently grow with increasing ITD.

**Conclusion:** Preliminary data show that AEP to changes in ITD can be obtained from school-age children. The full dataset, which is expected to be available in spring, will allow us to (1) establish a normative dataset and (2) investigate whether differences in response patterns between adults and children can be explained based on maturation.

# EFFICACY AND FEASIBILITY OF STAPEDIUS MUSCLE ELECTROMYOGRAPHY TO ASSESS COCHLEAR IMPLANT ELICITED STAPEDIUS REFLEX INTRAOPERATIVELY USING RETROFACIAL EXPOSURE OF STAPEDIUS MUSCLE: A PROSPECTIVE OBSERVATIONAL CLINICAL STUDY

**Prof. Dr. Orlando Guntinas-Lichius**<sup>1</sup>, Dr. Thore Schade-Mann<sup>2</sup>, Dr. Gerd Fabian Volk<sup>1</sup>, Prof. Dr. Hubert Löwenheim<sup>2</sup>

<sup>1</sup>Jena University Hospital, Jena, Germany, <sup>2</sup>University of Tübingen Medical Center, Tübingen, Germany

**Background:** Electromyography (EMG) signals of the stapedius muscle (SM) elicited by the stapedius reflex (SR) are reliable for cochlear implant (CI) fitting intra- and post-operatively, but are challenging due to the SM's small size. This clinical study aimed to evaluate the feasibility and efficacy of a retrofacial approach to access the SM, using pre-operative 3D imaging for surgical planning and real-time intraoperative EMG signal acquisition, to record the SR response using EMG during CI surgery.

**Methods:** Seventeen CI patients from Jena and Tübingen, Germany, were included in this study. Based on the 3D imaging, SM exposure and electrode placement were done via retrofacial or pyramidal eminence approach (anterior to the facial nerve). CI stimulation was used to elicit the SR, which was assessed visually and via EMG recording.

**Results:** Thirteen patients were included in this study; four were withdrawn for non-compliance with selection criteria. SR EMG was recorded successfully in 8 of the 13 patients. There was a strong correlation between the SR EMG signal and the visual detection of the SR ( $r=0.93$ ) at the stapedius tendon, after signal processing to remove artifacts. The EMG signal preceded visual detection of the SR in 41% of cases.

**Conclusion:** The findings indicate the feasibility and reliability of intraoperative SR-related EMG recording. The retrofacial approach for SM exposure and electrode placement was feasible and effective. This study highlights the potential of this approach for SM exposure and EMG-based SR detection in future CI systems.

## THE IMPACT OF STIMULUS BURST DURATION ON ELECTRICALLY EVOKED STAPEDIUS REFLEX THRESHOLDS IN PEDIATRIC COCHLEAR IMPLANT USERS: PRELIMINARY FINDINGS

**Dr Adam Walkowiak**<sup>1</sup>, M.Sc. Alejandra Kontides<sup>2</sup>, Prof. Piotr Skarżyński<sup>1</sup>, Prof. Henryk Skarżyński<sup>1</sup>, Prof. Artur Lorens<sup>1</sup>

<sup>1</sup>Institute Of Physiology And Pathology Of Hearing, World Hearing Center, Kajetany, Poland, <sup>2</sup>MED-EL Medical Electronics, Innsbruck, Austria

**Background:** The electrically evoked stapedius reflex threshold (eSRT) serves as an objective measure to optimize cochlear implant (CI) fittings. This study aimed to investigate how different burst durations influence eSRT determination in pediatric CI users.

**Methods:** Stimuli with varying burst durations (100–500 ms) were applied to assess their effects on reflex determination in 11 pediatric CI users. Measurements were taken at electrode contacts at the basal, medium and apex positions, 9 months post-CI activation.

**Results:** Longer burst durations yielded the lowest eSRT thresholds, while basal electrode contacts required the highest stimulation levels to elicit a reflex. No significant interaction was found between electrode contact site and burst duration.

**Conclusion:** Optimal burst duration depends on the interval: longer durations are effective for estimating most comfortable levels (MCLs) during earlier intervals, whereas shorter durations are preferable for later intervals. These findings can guide clinicians in optimizing CI fittings when behavioral responses are unreliable.

# PECULIARITIES OF AUDITORY EVOKED RESPONSES TO ACOUSTIC AND ELECTRIC STIMULATION

**Prof George Tavartkiladze**<sup>1</sup>

<sup>1</sup>Russian Medical Academy For Continuing Professional Rducation, Department Of Clinical Audiology, Moscow, Russia, <sup>2</sup>Research Institute of Experimental and Clinical Audiology, Moscow, Russia

**Background:** The aim of this study was to investigate the peculiarities of auditory evoked responses to acoustic and electric stimulation.

**Methods:** Registration of auditory nerve compound action potential (CAP, ECAP) during electrocochleography and neural response telemetry, registration of auditory brainstem (ABR, EABR), and cortical auditory evoked responses to acoustic and electric stimulation.

**Results:** ECAPs had shorter latencies, higher amplitudes and steeper growth functions than similar parameters during acoustic stimulation. With electric stimulation, a greater amplitude and shorter latencies of the ABR waves were also determined. It was noted that the latency of wave V had smaller values when recorded from more apical electrodes in comparison with recordings from basal electrodes. With stimulation of apical electrodes EABRs were registered with greater amplitude and better morphology. The greatest amplitude of the P1-N1-P2 complex was also obtained during stimulation of the apical electrodes, and the most stable was the N1 peak.

**Conclusions:** In general, electrically evoked potentials have characteristics like potentials recorded to acoustic stimulation. At the same time, electric stimulation eliminates processes that are normally present in the cochlea. The auditory nerve fibres that respond with synchronous discharges to click stimulation originate mainly from the basal regions of the cochlea, while with electric stimulation all fibres respond synchronously. An increase in amplitude in apical recordings could be explained by greater preservation of neurons and a smaller distance between the test and stimulating electrodes and the stimulated nerve structures in this area.

# AUDIOLOGICAL AND SUBJECTIVE BENEFITS IN A CHILD WITH MICROTIA AND ATRESIA AFTER SEQUENTIAL BILATERAL IMPLANTATION WITH ACTIVE BONE CONDUCTION DEVICES: A CASE STUDY

**Prof. Piotr Skarzynski**<sup>1,2</sup>, PhD Katarzyna Beata Cywka<sup>1</sup>, PhD Anna Ratuszniak<sup>1</sup>

<sup>1</sup>World Hearing Center, Institute Of Physiology And Pathology Of Hearing, Kajetany, Warsaw, Poland,

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With bilateral hearing loss, the main problems for the patient are speech understanding in noise and, especially in asymmetrical hearing loss, an inability to correctly localize sound sources. There are multiple methods of treatment and rehabilitation of conductive hearing loss, and one of them is to use an active bone conduction implant. This case study is designed to evaluate auditory benefits and sound localization accuracy with active bilateral bone conduction implants in comparison to unilateral ones in a patient with congenital bilateral conductive hearing loss caused by a congenital malformation. We assess subjective and audiological benefits (functional, directional hearing, speech comprehension in quiet and noise).

This study describes results in a 15-year-old patient with bilateral congenital malformation of the outer ears and associated conductive hearing loss who was treated with two Bonebridge active bone conduction implants. Speech recognition ability, hearing thresholds, and sound localization were tested: unaided, unilateral on the right side, and bilateral on both sides. The patient filled in an Abbreviated Profile of Hearing Aid Benefit questionnaire (APHAB) to evaluate limitations in daily life caused by hearing impairment.

Results show an improvement in free-field hearing thresholds and ability to discriminate speech in quiet and in noise after implantation. Subjectively, the patient had significantly fewer problems with two implants than with one (or without implant) in terms of hearing in everyday situations.

Unilateral use of the Bonebridge device in a patient with congenital bilateral conductive hearing loss did not provide full benefits. However, bilateral implantation improved speech understanding in noise and sound localization.



## Free Paper Session 18 - Vertigo & Balance Disorders

Room Hartmann, May 17, 2025, 10:40 - 12:10

### EXPLORING APPLICATIONS OF ELECTRICALLY EVOKED COMPOUND ACTION POTENTIALS USING THE VESTIBULAR IMPLANT

**Msc. Stan Van Boxel**<sup>1</sup>, MD Bernd Vermorcken<sup>1</sup>, MD Benjamin Volpe<sup>1</sup>, Dr. Angélica Perez-Fornos<sup>2</sup>, Dr. MD Nils Guinand<sup>2</sup>, Dr. Elke Devocht<sup>1</sup>, Prof. Dr. Dr. Raymond van de Berg<sup>1</sup>

<sup>1</sup>Department Of Otorhinolaryngology And Head And Neck Surgery, Maastricht University Medical Center, Maastricht, The Netherlands, <sup>2</sup>Hopitaux Universitaire de Geneve, Geneva, Switzerland

**Introduction:** Vestibulo-cochlear implants are a potential treatment approach for vestibulopathy patients. A critical aspect of advancing these implants is the development of reliable and objective outcome measures. As in cochlear implant care and other neural prostheses, electrically evoked compound action potentials (ECAP) can be used to measure the neural response to implant stimulation. The current study aims to explore the role of ECAPs in vestibulo-cochlear implant research.

**Methods:** ECAPs were measured in ten subjects with a vestibulo-cochlear implant. Different configurations were used, i.e., trans-canal, vestibulo-cochlear and cochleo-vestibular. The predictive value of ECAPs was evaluated for four outcomes: presence of an electrically evoked vestibulo-ocular reflex (eVOR), misalignment in the eVOR, auditory perception due to vestibular stimulation and the prevalence of cochlear to vestibular interaction.

**Results:** The results demonstrated a high positive predictive value of the ECAP for the presence of an eVOR (i.e., 1), while the negative predictive value was low (i.e., 0.54). The positive and negative predictive values of the ECAP for misalignment in the eVOR and auditory perception were low (i.e.,  $\leq 0.5$ ). ECAP recordings in the cochlea to vestibular set-up imply a high likelihood of cochlear to vestibular interaction (i.e., 67% of electrodes).

**Conclusion:** The presence of a vestibular ECAP has high predictive value for the presence of an eVOR. ECAPs are not reliable to predict the presence of eVOR misalignment, or the presence of auditory perception during vestibular stimulation. Nevertheless, the results imply spread of exciting between semi-circular canals and cochlea, already at clinically relevant stimulation levels.

## THE EFFECT OF TILT POSITION ON VOOCR PARAMETERS: A STUDY IN HEALTHY YOUNG ADULTS

**Sema Satici**<sup>1,2</sup>, Research Assistant Ahsen Kartal Özcan<sup>1,2</sup>, Associate Professor Zahra Polat<sup>1,3</sup>

<sup>1</sup>Department of Audiology, Hamidiye Faculty of Health Sciences, University of Health Sciences, Istanbul, Türkiye, <sup>2</sup>Audiology and Speech Disorders PhD Program, Institute of Health Sciences, Marmara University, İstanbul, Türkiye, <sup>3</sup>Audiology and Speech Disorders Center, Umraniye Training and Research Hospital, University of Health Sciences, İstanbul, Türkiye

**Background:** The video Ocular Counter Roll (vOCR) test is conducted by tilting the head in the roll plane and is used to evaluate otolith organ function. This study aims to determine static vOCR, gain, and asymmetry parameters in healthy young adults during head and body tilt positions.

**Methods:** Sixty healthy individuals (38 females, 22 males) aged 18-30 years (mean age:  $22.99 \pm 2.90$ ) with normal audiovestibular findings were included in the study. vOCR assessments were performed in two positions: 30° lateral head tilt and 30° lateral body tilt. Three recordings were obtained for each position, and the averages of these recordings were used for analysis. Static vOCR, gain, and asymmetry values were compared across tilt position changes.

**Results:** Static vOCR during head tilt ( $6.50^\circ \pm 1.35$ ) was significantly lower than during body tilt ( $8.09^\circ \pm 1.71$ ) ( $p < 0.001$ ). Similarly, vOCR gain recorded during head tilt ( $0.23 \pm 0.06$ ) was significantly lower than that recorded during body tilt ( $0.27 \pm 0.06$ ) ( $p < 0.001$ ). No significant difference was found in vOCR asymmetry between head tilt ( $0.06 \pm 0.05$ ) and body tilt ( $0.06 \pm 0.06$ ) ( $p > 0.05$ ).

**Conclusion:** The findings suggest that body tilt results in higher static vOCR and gain values than head tilt, indicating a potential positional influence on responses mediated by the otolith organ. These results emphasize the importance of considering tilt position when interpreting vOCR outcomes and underline the need for further normative studies to enhance clinical application and understanding of this test.

## AUDIOVESTIBULAR DISORDERS IN SURGICALLY TREATED PATIENTS WITH CHRONIC OTITIS MEDIA

Professor Ana Jotic<sup>1,2</sup>, Professor Ljiljana Cvorovic<sup>1,2</sup>, **Assistant Professor Bojana Bukurov**<sup>1,2</sup>, Dr Dragana Nenezic<sup>1</sup>, Dr Dragana Milivojevic<sup>1,3</sup>

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**Background:** Hearing loss is a common symptom of chronic otitis media (COM), but the interest in vestibular system impairment has only become the focus of research in recent years. Estimated the incidence of vestibular symptoms in these patients is high and ranges from 40% to 60%. The aim of this study was to establish the presence of vestibular disorders in patients with COM planned for surgical treatment and to identify potential predictive factors for the development of these disorders.

**Methods:** The cross-sectional study would included 34 patients with COM. The diagnosis was made after clinical examination and otomicroscopy, computerized tomography (CT) of the temporal bones, and audiological diagnostics. Vestibular diagnostics included video HIT test, VEMP, subjective visual vertical test and fistula test. All diagnostic procedures were performed prior to surgical treatment. Control group consisted of 25 healthy volunteers who corresponded in gender and age to patients enrolled the study, without any otological and audiovestibular disorders.

**Results:** Patients with COM with cholesteatoma more frequently had pathological findings on all conducted vestibular testing ( vHIT, VEMP, SVV) comparing to patients with mucous form of chronic otitis media. Duration of the disease, presence of mixed hearing loss and presence of cholesteatoma were identified as predicting factors of vestibular disorders.

**Conclusion:** The results are suggesting impairment of vestibular function in patients with COM with and without cholesteatoma is frequent, which suggests that vestibular diagnostics are needed to better understand the clinical correlation of chronic otitis with vestibular impairment.

## THE IMPACT OF TARGET POSITION ON VOOCR RESULTS IN HEAD AND BODY TILTS

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**Background:** Video ocular counter-roll (vOCR) is a novel test developed to evaluate otolith organ function. It is characterized as a vestibulo-ocular reflex response to lateral tilt, producing torsional eye movements. While previous studies have utilized three targets to assess vOCR, the recently commercialized VNG device's test battery supports testing with only one central target. This study aims to investigate the effects of using three target points (one central and two lateral) on vOCR outcomes in two different (30° lateral head tilt and body tilt) positions.

**Methods:** Thirty healthy adults (15 female, 15 male) aged 18-30 with normal audiovestibular findings were included. vOCR evaluation was performed in two positions: 30° lateral head tilt and 30° lateral body tilt. Recordings were obtained while participants fixated on a central target and on right/left lateral targets during the tilt positions. Three recordings were obtained for each condition, and the average results were used for analysis. Static vOCR, gain, and asymmetry values were compared across different target conditions.

**Results:** Significant differences were observed in static vOCR and gain values between the central target and the two lateral targets in both head and body tilt positions ( $p < 0.001$ ). In the vOCR asymmetry value, no statistically significant difference was obtained in the target changes in both positions ( $p > 0.05$ ).

**Conclusion:** Static vOCR values obtained with lateral targets were lower compared to those obtained with the central target. Clinicians using commercial VNG devices for vOCR assessment should consider these differences when interpreting their results.

## THE COCHLEO-VESTIBULAR IMPLANT: UPDATES ON THE VertiGo!-TRIAL

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**Background:** Vestibular implants targeting the semi-circular canals offer a potential treatment approach for vestibulopathy patients. Motion information is provided by electrical stimulation of all three canals, aiming on restoring vestibular function. In the currently running VertiGo!-trial, the safety and efficacy of a novel cochleo-vestibular implant is evaluated.

**Methods:** Currently, ten subject were implanted with an investigational cochleo-vestibular implant. These subjects underwent multiple week of fitting and stimulation. Multiple domains of vestibular function were evaluated during these weeks. These included, but were not limited to, evaluating safety, balance restoration, fitting strategies and vestibular processing.

**Results:** Although the trial is still running, multiple results are already obtained. These include results on surgery, gaze stabilization, motion perception and vestibular processing. Significant improvements were observed, in multiple domains, as a result of vestibular implant stimulation.

**Conclusion:** The first observations from the currently running trial demonstrate the high potential for the vestibulo-cochlear implant to restore vestibular function in vestibulopathy patients.

# INFLUENCE OF JOINT HYPERMOBILITY ON STATIC BALANCE CONTROL: A SYSTEMATIC REVIEW

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**Background:** Joint hypermobility (JH), characterized by an increased range of motion in the joints, may affect static balance (SB) due to osteo-connective-articular disorders. Although its assessment is not typically included in vestibular assessments, its impact on SB tests remains unclear. This study aims to systematically review recent literature to determine the relationship between JH and SB performance.

**Methods:** A systematic search was conducted in Web of Science, Scopus, PubMed, ScienceDirect, and SciELO databases for studies published between 2014 and 2024. Studies evaluating SB in individuals with JH were included. The selected articles were analyzed to identify their findings.

**Results:** Eight studies met the inclusion criteria. The findings indicate that JH is associated with increased postural sway, particularly in the anteroposterior direction, and a greater reliance on visual input to maintain stability. Instrumental assessments, such as force platforms, confirmed significantly less stable postural control in individuals with JH, especially under eyes-closed conditions. Additionally, a lack of consensus was observed regarding the protocols and tools used.

**Conclusion:** JH is a relevant factor in SB, highlighting the need to standardize evaluation methods and to consider this condition in clinical diagnoses.

# AN OVERVIEW OF THE ROLE OF THE MENIETT DEVICE IN TREATING MENIERE'S DISEASE

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**Background:** Meniere's is a disease characterized by episodic vertigo, hearing loss, tinnitus and aural pressure in the ear. Treatment options include prevention of attacks, medical treatment, surgical treatment and the Meniett device. Because of the natural history of Meniere disease, benefit of each treatment should be compared to a spontaneous improvement. The development of the miniaturized, portable Meniett device may provide the accessibility of this treatment. The aim of this study is to evaluate the effectiveness of the Meniett device in individuals with Meniere's disease.

**Methods:** Studies using the Meniett device in the treatment of Meniere's disease, conducted between 2001 and 2025, were included in the review. To conduct a literature review, Cumulated Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis and Retrieval Systems Online (MEDLINE), Excerpta Medica Database (EMBASE), and PubMed were searched.

**Results:** Of 113 study screened 24 studies met criteria for overview. 19 studies reported improvements in hearing and balance functions after using Meniett device but 5 studies reported that Meniett device didn't produce significant improvements in hearing and balance functions.

**Conclusion:** Although many studies have shown that the Meniett device used in Meniere's disease causes improvement in patients' symptoms, there are also studies that haven't found any advantage. In general, it can be said that the Meniett device is a safe, non-destructive treatment method for the treatment of patients with Meniere's disease who are resistant to medical treatment.

# EXPLORING VESTIBULAR PATHOLOGY IN SEVERE HEARING LOSS: A CALL FOR COMPREHENSIVE SCREENING

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**Background:** The prevalence of associated vestibular impairments in individuals with severe hearing loss is reported to be very high (between 20-70%), depending on etiology. As most of these patients never experience vertigo, any person with hearing loss should be screened for associated vestibular pathology. This presentation aims to review the frequency of peripheral vestibular impairments in persons with severe hearing loss and to discuss the importance of vestibular examination in these patients.

**Method:** Data from complete vestibular testing of patients in the cochlear implant program (PTA>80 dB) over the last four years at our clinic will be presented.

**Results:** Associated vestibular damage was found as follows: absent cVEMPs and oVEMPs unilaterally in 17.3% and bilaterally in 30.8% of patients. VOR gain measured by vHIT was less than 0.6 in 10.9% of patients unilaterally and 23.9% bilaterally. Hyporeflexia on caloric testing was observed in 26.5% of patients on one side and complete areflexia in 12.2% bilaterally. Overall, 57.7% of patients had some degree of peripheral vestibular dysfunction, and 13.5% fulfilled the criteria for bilateral vestibulopathy (BVP).

**Conclusions:** Recognizing vestibular impairments in persons who are candidates for cochlear implantation is crucial, as it directly impacts their balance maintenance and safety. It is essential to consider the significant effects of bilateral vestibular impairment on cognitive development and the increased physical effort required for everyday activities. Comprehensive vestibular testing should become a standard part of the evaluation process for cochlear implant candidates.