10th European Federation of Audiology Societies (EFAS) Congress

Keynote Lectures

KL-01

Cochlear Implant-eluted dexamethasone protects the cochlea against the trauma-induced increases in pure-tone evoked cochlear action potential thresholds from becoming permanent

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Background: *In vitro* and *in vivo* results show that dexamethasone (DXMb) protects hair cells (HCs) and hearing from trauma/inflammation-induced hearing losses.
Aims: Determine if polymer-eluted DXMb retains its ability to protect against trauma-induced HC and hearing losses.
Methods: *In Vitro*-organ of Corti (OC) explants tested the efficacy of polymer-eluted DXMb to protect against tumor necrosis factor-alpha (TNFa) ototoxicity and to initiate gene expression. RT-PCR quantified expression of 3 apoptosis-related genes (i.e. Bcl-2, Bcl-xl and Bax) and 1pro-inflammatory gene (i.e. TNFR1). In Vivo- guinea pigs; hearing thresholds obtained by recording cochlear action potentials (CAPs) in response to 0.5, 1, 4, 16 kHz stimuli. Two types of electrodes tested: 1) silicone; and 2) silicone + 10% DXMb. Electrodes were inserted 5 mm into the scala tympani via a cochleostomy and were purposefully double inserted to create an elevated level of trauma.
Results: *In Vitro*-Eluted DXMb is as effective as natural DXMb for protecting HCs and initiating changes in gene expression that promote HC survival in TNFa-challenged OC explants. In Vivo-Cochleae implanted with silicone electrodes had a 40 dB SPL increase in CAP thresholds for all four frequencies at 60 d post-electrode insertion trauma (EIT), in contrast the silicone/DXMb electrode cochleae had only a 2 dB SPL higher threshold that the pre-EIT levels. Initial threshold losses were similar in both groups following EIT for the 2 different electrode types, ie. 40 dB SPL.
Conclusions: Polymer-eluted DXMb is as effective as the natural form of this drug in protecting HCs against trauma-related losses and in inducing changes in gene expression that favor HC survival. There was a highly significant level of protection of CAP (i.e. hearing) thresholds against EIT-induced increases in the cochleae receiving the DXMb electrodes. A DXMb-eluting electrode may be an effective method to conserve hearing during after cochlear implantation.

KL-02

Sweeping noise method for psychophysical tuning curve determination (SWPTC)

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To assess the frequency selectivity of the auditory system Psychophysical Tuning Curves (PTCs) are often determined. They have also been used to detect "dead regions" in the cochlea and to define their frequency limits. However, the traditional method for determining PTCs is too time consuming for use in practice. Therefore, a fast method for measuring PTCs has been evaluated, refined and implemented in software that can be run on a PC with a good-quality sound card. The method is similar to that described by Sek et al. (2005) and is based on pulsed tone presented at a background of a narrow band masking noise that sweeps in centre frequency. A Békésy method is applied to adjust the masker level required for threshold of the tone. In addition to the narrowband masker, a lowpass noise masker can be presented to prevent detection of the pulsed tone based on distortion band corresponding to the simple difference tone. The software includes also a routine for measuring the absolute threshold at the pulsed tone frequency. Moreover, it includes several procedures for estimating the frequency at the tip of the PTC.
The fast method was evaluated using both normally hearing and hearing-impaired subjects and showed good agreement with the results of the traditional method. For subjects with dead regions, the fast method gave PTCs with shifted tips when the signal frequency fell within a dead region range, consistent with PTCs obtained using the traditional method
Using this software a single PTC can be determined in about few minutes. However, to get more stable and reliable results a small amount of practice, i.e. two to three runs, may be necessary. Using this implementation, PTCs can be measured quickly without a requirement for specialized laboratory equipment.

KL-03

Cochlear reaction to stapedotomy: Early and delayed bone conduction changes

Profant M.

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Background: Stability of the bone conduction threshold (BCT) after stapedotomy is the basic requirement for successful postoperative outcome. The early postoperative BCT is evaluated.
Material and Methods: A series of 45 patients after primary stapedotomy have been tested for the bone conduction threshold in the day 1, 7, 30, 180 after the surgery. The dynamic changes and final audiological outcome are evaluated.

Results: There were no significant audiological changes in the postoperative day 1 bone conduction threshold comparing to the measurements on the day 7, 30 and 180. The detailed results will be presented during the congress presentation.
Conclusion: The results show stable bone conduction threshold even from very early postoperative period. The dynamics in the early postoperative bone conduction threshold is the indication for early medical therapy in case of sensorineural hearing loss and may correlate with some technical problems during the surgery.
This work was supported by the Slovak Research and Development Agency under the contract No. APVV-0148-10.

KL-04

Uni- and bilateral cochlear implantation – effects on auditory performance, quality of life and psychological comorbidity

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Backround: Bilateral cochlear implant (CI) has been accepted as a safe and effective means of bilateral auditory stimulation. There is, however, an ongoing discussion about the validity and feasibility of bilateral CI in terms of outcome, justification of need, medical/surgical safety concerns, and economics. An important additional issue is extra benefit of the bilateral CI on health-related quality of life (HRQoL), on tinnitus and on psychological comorbidity. The goal of this presentation is to review the information published on the subject so far and to present own data regarding comparative analyses of the quality of life and speech perception with special reference to tinnitus and psychological comorbidity after unilateral and bilateral CI.
Methods: Forty postlingually deafened adult patients who were sequentially implanted with a multichannel cochlear implant for at least 6 months were included in this study. We evaluated the quality of life, tinnitus impairment, perceived stress, depressive and anxiety symptoms and coping strategies during the time course (pre-CI, post-first CI and post second CI), using 6 validated questionnaires: the Nijmegen Cochlear Implant Questionnaire (NCIQ), the Tinnitus-Questionnaire (TQ) by Göbel and Hiller, the Perceived Stress Questionnaire (PSQ), the Brief Cope and finally the General Depressions Scale (ADSL) and the General Anxiety Disorder-7-questionnaire (GAD-7). In addition to the tests listed above, speech perception tests for each implanted ear and in the binaural condition in quiet and noise (Freiburger monosyllables, HSM and OLSA sentences) and speech localization abilities were evaluated.
Results: Bilateral implantation resulted in a statistically significant improvement of HRQoL as compared to unilateral CI. There was a significant decrease of tinnitus-related distress and perceived stress after the first implantation and further reduction after bilateral CI. Furthermore, the scores of psychometric questionnaires indicated significantly lower anxiety and depressive symptoms after CI. Use of two CI`s versus one resulted in a significant improvement in all speech perception tests in quiet and noise. In addition, bilaterally implanted patients benefited from the head-shadow-effect, from binaural squelsh and from binaural summation.
Conclusions: Cochlear implantation influences positively the quality of life, induces habituation of tinnitus, and lowers the stress perception and psychological comorbidity in postlingually deafened adults. Bilateral CI provides additional benefit over unilateral CI in all areas tested.

KL-05

Cochlear implantation in single-sided deafness improves spatial hearing and tinnitus

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Aim: To study the benefits of CI in single-sided deafness (SSD) on speech perception and tinnitus.
Materials and Methods: 29 patients with SSD received a CI. Spatial speech in noise tests were performed to detect binaural and bilateral effects. Tinnitus loudness was assessed with a visual analogue scale and psychoacoustically in dB sensation level.
Results: 12 months after first fitting a significant combined headshadow- and squelch effect was present for patients with contralateral normalhearing (NHgroup) and contralateral moderate hearing loss(HLgroup). A squelch effect was present in the HLgroup. After 36 months a significant summation effect was measured in NH and HLgroup respectively of 1.6dB and 3.5dB, squelch effect: 2.1dB and 4.0dB and combined headshadow- and squelch effect of 2.2dB and 6.7dB. Concomitant tinnitus significantly reduced with CI stimulation.
Conclusions: CI can significantly improve speech perception in noise and restore binaural hearing in SSD and significantly reduces concomitant tinnitus.

KL-06

Psychopathology of vestibular migraine: what is the mechanism?

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Background: There is a high prevalence of depressive and anxiety disorders in both individuals with migraine and also

those with vestibular disease. Previous work has suggested that there is a specific association between migraine, vestibular disease, and anxiety disorders, but the precise mechanism is unknown. This study was designed to investigate the role vestibular symptoms play in the psychological symptoms associated with vestibular migraine.

Methods: Two groups of patients were studied. The first was a group of 39 patients with vestibular migraine according to Neuhauser's 2001 criteria. The second group comprised 44 patients with dizziness symptoms without migraine. Patients completed validated questionnaires (Beck Depression Inventory, Beck Anxiety Inventory, Vertigo Symptom Scale). Regression analysis was carried out to determine predictors of depressive and anxiety symptom scores.

Results: The migraine group had significantly higher scores on the anxiety (BAI median 19) (p=0.03) scales than the non-migraine group (BAI median 11). There was no difference in depression scores (BDI median 10 for migraine, 8 for non-migraine, p=0.57). The migraine group also scored more highly than the non-migraine group on the vertigo severity and frequency scales (VSS vertigo scale median 30 in the migraine group, 16 in the non-migraine group, p=0.003). Regression modelling showed that the high anxiety symptom scores were largely accounted for by the excess of vestibular symptoms.

Conclusions: This study has confirmed that patients with the vestibular subtype of migraine have high anxiety symptom levels when compared to non-migrainous dizzy controls, and suggests that this difference may be largely explained by high levels of vertigo symptoms.

KL-07

My perspective on audiology and otology

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Recently we have been seeing impressive new developments: possibilities for early detection of hearing impairment, options of early surgical and non-surgical therapies for a number of different ear diseases, the early provision of hearing aids, and advances in implantable hearing aids, both cochlear and middle ear. Additionally we have organized and implemented several programs like "telefitting" (the remote fitting of implanted patients), "telediagnostics" (remote diagnostics), and "telerehabilitation", all of which are done over the Internet.

A modern point of view on all of this must take into account two factors. First, there is now a vast amount of medical activity applied to hearing patients, including treatment involving pharmacological measures or surgery. Secondly, audiology now involves clinical engineers, psychologists, educators, and speech therapists. This means that the diagnosis, treatment, and rehabilitation of the hearing impaired is largely interdisciplinary. If it were not for these numerous specialists, progress in our scientific and medical fields would have been impossible. This sea change also motivates us to reexamine our job descriptions and decide who is or who should be the lead audiologist. What team members are needed in a clinical center, and what services need to be delivered to the hearing impaired, from new-born to elderly? Finding the optimal organizational model is extremely important from a formal and legal point of view. Each specialist from the above-mentioned fields needs to be assigned clear tasks in their work with hearing impaired patients. I think there is a great need to go back to fundamentals and discuss the idea of what is a "General Audiologist" and decide which speciality it belongs to. The contemporary literature is full of descriptions of the same problems but attributed to patients with different hearing impairments. New methods of therapy and their verification are therefore often based on totally different data sets. The result is that our community of various specialists often provide patients with different interpretations and explanations of what modern audiology and otology can offer them. Good examples are cases of total deafness, various types of partial deafness, related to central auditory processing disorders, and age-related hearing loss. The main aim of this lecture prepared for the community of EFAS is to begin a fresh and focused discussion on this subject. I hope that after several working group meetings it might be possible to prepare a joint statement on what the modern field of audiology actually is and how it relates to contemporary science and medicine.

KL-08

Issues of extending steady-state stimulus-response approach to later potentials: Results in children and non-alert adults

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Considerable attention has been given to the auditory steady-state responses (ASSRs), especially electric-audiometric applications. These interests/applications ostensibly overlap conventionally recorded early and middle auditory evoked potentials, using essentially an impulse-response stimulus-response approach. The SSR approach, however, can be extended to latency ranges corresponding to later potentials. Collectively, analyzing effectively broader ranges of potentials, apropos their putative levels of generation along the auditory pathways, may open the door wider to current applications of ASSRs, if not other doors of applications, both of ERA and oto-neurological interests. Presented here is such a SSR approach, the theoretical basis of the approach to long-latency-equivalent potentials, and a summary of initial proof-of-concept. Namely, results are presented covering stimulus repetition rates from 0.75 Hz to 80 Hz to elicit quasi-steady-state responses in intact college-aged volunteer subjects. Additionally, results are presented that are encouraging for future applications in children (ages 6–9 examined) and/or subjects of reduced levels of arousal.

KL-09

Neuroanatomical features of Heschl's gyrus and the Superior Temporal Plane

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Neuroaudiology Lab, University of Connecticut

Interest in the gross anatomy of the human brain has increased due to use of positron emission tomography (PET) and functional magnetic resonance imaging (f MRI) world wide. This study has focused on the morphological characteristics of Heschl's gyrus (HG) and the superior temporal plane (STP) in an attempt to describe this anatomical region and define it's natural variability. Forty three adult human brains were examined and HG and STP were exposed. Using established measurement techniques, the morphology of HG was described and measured in each hemisphere. HG was defined by two sulci, temporal (anterior) and Heschl's (posterior). The location of HG anterior most fringe on the superior temporal plane was determined to be on average 5.3 cm anterior to posterior along the Sylvian fissure. Identified were either one, two or three HG in each hemisphere. The average length of HG was 3.4 cm on the left and 3.1 cm on the right, however this metric was dependent on whether or not the Sylvian fissure had an ascending ramus. Sylvian fissures with an ascending ramus yielded smaller HGs. Measurements of other segments of the STP and it's relationship to HG and the planum temporale will also be presented. Implications to these findings to functional imaging, and clinical assessment of central auditory disorders including central deafness will be presented.

KL-10

Distribution of single-sample EPs in the human auditory nerve

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Brainstem auditory evoked potentials (BAEPs) have traditionally been measured using signal averaging techniques in the time domain. BAEPs are a result of time-locked neural firing response patterns in the auditory brainstem pathway. Since the BAEP is in response to multiple samples, it is not possible to describe the distribution of auditory nerve firing patterns to single sample acoustic stimulation. The ability to describe the distribution of auditory nerve firing patterns in human auditory evoked potentials has implications in the understanding of auditory disorders affecting synaptic activity of inner hair cells and VIIIth nerve dendrites in the auditory nerve. In this study a single sample evoked potential measuring technique is described as a method of measurement of wave I of the BAEP. Thirty young adult college students between 18 and 26 years of age were tested. A post-stimulus time histogram was constructed by collecting single samples of wave I in a stimulus-on condition (two sets of 4000 samples at 80 dB nHL), and in a stimulus-off condition (two sets of 4000 samples). A cross correlation technique was used to obtain a correlation value at each point along the sample. The peak correlation for each sample within a condition was then displayed as a post-stimulus time histogram. A Kolmonov-Smimov statistic was used to determine differences between the stimulus-on condition and the stimulus-off condition of the post stimulus time histograms. In addition the distribution of the post-stimulus time histogram was visually compared to the time-averaged waveform. This study has shown that it is possible to measure wave I of the human BAEP using a technique that measures single sample auditory evoked potentials. The distribution of wave I may be observed using the statistical techniques presented in this study to construct a post-stimulus time histogram. The distribution of the post- stimulus time histogram may be described as a Poisson distribution similar to that seen in animal studies of single auditory nerve fiber responses (Kiang, 1965). It is believed that this technique may provide some new insights into sensorineural hearing loss and diseases affecting auditory nerve function, especially those that appear to affect temporal synchrony such as auditory neuropathy and demyelinating diseases.

KL-11

Electrical stimulation for tinnitus treatment

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For decades, the use of electricity presented to the cochlea has been shown to reduce tinnitus in some patients. Several studies have shown that between 40–70% of cochlear implant (CI) recipients report a tinnitus reduction. Pre and post Tinnitus Handicap Questionnaires indicate long-term reduction in the reactions of tinnitus patients. More recent studies have shown benefit in unilateral deaf patients with unilateral tinnitus also show a tinnitus reduction. We have been performing laboratory trials exploring different pulse train repetition rates, electrode locations and stimulus levels. We also explore the effects of up to 20 minutes of continuous stimulation. The results show a wide range of individual differences across all variables studied. For some subjects, a single basal electrode with low current levels was sufficient to suppress tinnitus.

Support from the Royal National Institute from the Deaf, Tinnitus Research Initiative, and Cochlear Corporation.

KL-12

Active otological implants – an overview

Raine C.

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Whilst the majority of patients with a hearing loss can be helped with acoustic aids – a few can't. This might be as a result of congenital malformations, single sided deafness or more commonly the inability to wear moulds because of irritation and infection as a result of either external or middle ear disease. Sometimes acoustic aids suffer from distortion and feedback.

The principles of 'active implants' have been around for a number of years. The concept is to provide vibrational energy either directly to the cochlear or indirectly via existing middle ear structures. Two main mechanisms are used in supplying energy these are Piezoelectric or Electromagnetic.

In most circumstances the systems consist of an external microphone, processor and transmitter, with an internal receiver and actuator producing the vibrations. A few devices are now totally implantable. The bone conduction systems whilst based on electromagnetic principles stimulate the cochlear with connection either onto a percutaneous abutment implanted into the skull or by magnets.

Engineering such devices is a challenge. The mechanisms involved in hearing are very delicate and respond to amplitudes of molecular dimensions. Devices have to be capable of producing the appropriate frequency response, fidelity and quality. Equally they have to be of the appropriate size, weight and biocompatibility.

A few devices are well tried and tested and been on general commercial release for a number of years. These together with devices under development or in clinic trial will be presented looking at clinical indications and audiological fitting parameters for patients with conductive and mixed hearing losses.

Conclusions: Excluding cochlear implants active otological implants have greatly improved how we can treat patients with a variety of external and middle pathologies presenting with conductive and mixed hearing losses.

KL-13

Musical instrument identification among pre-lingual Cochlear Implant recipients at a school in the Philippines

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Music appreciation among pre-lingually deafened children has always been a difficult area of research considering the lack of reference this population have. Utilizing basic tools to recreate music, noise, and musical instruments, this research sought to provide basic information that will serve as foundation for a bigger scale research on children who received cochlear implants in the Philippines.

Aimed at determining the ability of pre-lingual, cochlear implant recipients in identifying musical instruments, the paper will present data gathered according to hearing threshold, music and noise identification, and musical instrument identification.

10th European Federation of Audiology Societies (EFAS) Congress

Round Tables

RT01

Audiology in Europe. 20 Years of EFAS

Moderators: Jose Juan Barajas de Prat, Henryk Skarzynski, Lech Sliwa

Speakers:
1. **Jose Juan Barajas de Prat**
2. **Jonathan Hazell**
3. **Josef Syka**
4. **Martti Sorri**
5. **Rene Dauman**
6. **Kajsa-Mia Holgers**
7. **Thomas Lenarz**
8. **Birger Kollmeier**
9. **Stig Arlinger**
10. **Hans Verschuure**
11. **Franz Zenker Castro**

Summary
This Round Table has been designed to review the trajectory of EFAS and its future trends. Relevant speakers that have been supporting EFAS along these years will take part in this RT. The following issues will be addressed: 1) Present format of the Congress and its topics. Do we need a more clinical orientated society? 2) At present EFAS activity has been restricted to a biannual Congress celebration. Do you think that we suppose to implement this activity? If so which ones? 3) Which role do you think EFAS should have as a possible link between the Research European projects? 4) Do you think that EFAS can help in developing the audiological standards that can be recommended across Europe? 5) Do you think that EFAS has a role in establishing the ethics in Audiology in Europe?

RT01-05

What I have learned from EFAS

Dauman R.

Hôpital Pellegrin, Service ORL, Bordeaux, France

Jonathan Hazell and Stig Arlinger, who together were some kind of god fathers for EFAS, have asked me in Cambridge in 1992 to be the representative of France. This gave me very early the opportunity to take part in different working groups, an experience that showed me immediately the diversity in practicing and teaching Audiology across Europe. The year after, in Hannover, a few friends suggested me to apply for Vice-presidency of EFAS and I was elected. This certainly played an important role in my carrier allowing me to be part of the Board over 6 years. Among the things that I recall there is the visit of support to Jarka Prihodova conducted by EFAS Board in 1996 in Prague, thanks to the generosity of the Dutch group who had been successively organizing the EFAS meeting in Nordwijkerhoot. And also in Oulu, Finland, at the end of my Presidency, when we prepared hundreds of envelopes of envelopes with the team of Martti Sorri the day before the conference. I also remember the General Assembly of EFAS in Bordeaux in September 2001, when a medical doctor and a PhD in Audiology from the same country disagreed openly on the content of the curriculum scheduled by EFAS for the General Audiologist project. Beyond their specific meaning, the above mentioned events or anecdotes were all characterized, in my mind, by friendship.
What happened a few years later at the EFAS general assembly in Tenerife was somewhat different. With my appointment to the function of General Secretary of CORLAS in 2008, I have learned to defend my convictions when the matter is important, and this was the case in Tenerife when Vice-presidency was discussed. To those who found my words unusually tough or embarrassing, I present my apologies, but still nowadays I feel pride from my determination on this day.

RT01-06

EFAS – my thoughts

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It is of great importance for European Federation of Audiology Societies to meet and share knowledge, and our congress is a great event and many important topics are discussed and the state of the art in many fields of audiology are addressed. One of our strengths is that we are a multi professional organisation with multidisciplinary knowledge and together we can serve our patients in a evidence-based way and iprove the knowledge in audiology.
According to EFAS by-laws, "the scope of our organisation is to promote cooperation, exchange of experience and knowledge of audiology within Europe, both as a scientific field and as a hearing health service offered to the public. EFAS may also act as a common spokesman for European audiology in relation to other organizations".
But what is the purpose of EFAS today, and what is the future of EFAS? Does Europe need a voice emphasising the importance high quality health services to people with audiological problems? Absolutely, The number of people in need of audiological services is increasing.

How can EFAS contribute to high quality health care? Have we done that? Are we doing this?
When going back and look upon all efforts that have been put into the work from members of EFAS, it is very clear that we can say YES to these questions. However, more can be done.
I made an analyse of all information gathered in the Minutes from all General Assemblies of EFAS, as well as from other documents from our organisation from the start in 1992, in order to see when we have been successful and when we been less successful. From my point of view, I have found a pattern.
The following factors related to success emerged:
1. Networking.
2. Collaboration between countries.
3. Promoting education on basic level and continuous professional education.
4. Communicate new knowledge.

And the factors of failure were the opposite.
For example, already at the start of EFAS, it was discussed the need of identifying the status of the audiological training in Europe. This overview of the situation during the 90:ties led to the General audiologist model, where almost all EFAS member countries were represented in the working group.
There were other initiatives taking place, for instance the TEMPUS programme in which EFAS supported audiological education together with the local EFAS representatives and local universities. This was very successful.
And have course our biannual conferences – What next?
Even though EFAS has presented a model for general audiologist, this model needs to be discussed further and updated based on new knowledge that emerges.
We also need a consensus on the levels of knowledge and skills needed to practice audiology at a specialist level.
For instance, there are actions taken by other organisations, to get a consensus of the skills required for practicing audiological medicine, in this work the input from a multiprofessional organisation, as EFAS, is of great value.
However, the by far most important issue is how do we bridge the gap between new research findings and clinical practice. We have to adopt strategies to facilitate the implementation of evidence-based audiology in order to secure high quality of audiological services. For this important task our identified success factors still are applicable:
Let's all together go forward to meet the new challenges of today and tomorrow, with respect for the multi professional knowledge and skills within our organisation. But above all show respect for the need of our customers/patients!

RT01-08

Turning audiology into an "exact" science – How far did we yet come with EFAS?

Kollmeier B.

Universität Oldenburg, Oldenburg

"Audiology in Europe" set out 20 years ago to form a European, multidisciplinary, scientific society that differs from the approach on other continents, e.g., by well representing its roots both from the "exact" natural and engineering sciences and the "soft" life and social sciences. Hence, the technical, medical, and educational approach to audiology was acknowledged as having equal importance, and the common goal was set to advance audiology as a multi-faceted, interdisciplinary science. The 8th EFAS congress in 2007 hosted by the German Society of Audiology was designed to follow both this spirit and the traditions established by the previous EFAS congresses. However, given the huge progress in audiological diagnostical, therapeutical and rehabilitative approaches during the last 20 years, did we really exploit all the new techniques, insights and theories in an optimum way that would make Europe the world leader in audiology?
While some aspects of audiology are definitely at the world-class level (i.e., number and quality of European-dominated hearing instrument manufacturers), other areas are lagging behind (such as, e.g., standards in neonatal hearing screening or audiological diagnostics and rehabilitation across European countries) even though EFAS has spent much effort here. The only way out is neither to lament the insufficient medical system in each country nor to report clinical "me too!" results. Instead, the scientific basis for a theory-driven diagnostic and model-supported auditory rehabilitation with innovative technical hearing devices has to be established within EFAS. Hence, the future of EFAS should be devoted to converting audiology into an "exact" science that profits from the interplay between experiment and theory as well as from basic science and high-level clinical research.

RT01-09

EFAS – history and future

Arlinger S.

Linköping University, Linköping, Sweden

1989 was a year that changed Europe. At the International Congress of Audiology in Tenerife 1990 Jonathan Hazell had gathered a group to discuss the formation of a European organization for audiology in this new perspective. At the British Audiology Congress in Cambridge 1992 EFAS was born and an interim council was formed. The by-laws, formulated 1993 in Hannover, state: The scope of EFAS is to promote cooperation, exchange of experience and knowledge of audiology within Europe, both as a scientific field and as a hearing health service offered to the public. EFAS may also act as a common spokesman for European audiology in relation to other organizations. The first real EFAS Congress was held in Noordwijkerhout 1994.
The scope was to be fulfilled not only by bi-annual congresses but also by other initiatives promoting European co-operation. Thus, in 1994 we applied to the EU-programme TEMPUS-PHARE to arrange courses in audiology for five former east-bloc countries. Only one was approved, Romania, and carried out 1995–97.
In 1997 another project was initiated which resulted in the concept General Audiologist and a model curriculum for a training program.
The future of EFAS should keep its focus on clinical audiology and hearing health services. This of course should be the landmark of future congresses. However, I hope that EFAS also will offer more activities, e.g. organizing short training courses in specific areas of relevance, in addition to the congresses with their broad spectra.

RT02

CORLAS: Contributions to European Audiology

Moderators: René Dauman, José Barajas

Speakers:
1. Jan Wouters
2. Norbert Dillier
3. Linda Luxon
4. Istvan Sziklai
5. Martin Kompis
6. Wieslaw Sulkowski

According to the International Society of Audiology (ISA), Audiology is the science of hearing. CORLAS is a scientific society whose members meet annually to share their research on ORL-Head Neck Surgery matters. When Prof. Skarzynski invited me to organize a CORLAS round table during the EFAS conference in Warsaw, I rapidly came to the idea of strengthening a desirable bridge between ISA and CORLAS and, thus, asked Prof. Jose Barajas to conduct with me the discussion. The basis of the session will consist of six articles published by the following CORLAS members:
1. Jan Wouters (Leuven, Belgium) – LIST and LINT: Sentences and numbers for quantifying speech understanding in severely impaired listeners for Flanders and the Netherlands (van Wieringen & Wouters, International Journal of Audiology 2008)
2. Norbert Dillier (Zurich, Switzerland) – Subjective and objective results after bilateral cochlear implantation in adults (Laske, Veraguth, Dillier, et al, Otology and Neurotology 2009)
3. Linda Luxon (London, Great Britain) – Evaluation of musical skills in children with a diagnosis of an auditory processing disorder (Olakunbi, Bamiou, Stewart & Luxon, International Journal of Pediatric Otorhinolaryngology 2010)
4. Istvan Sziklai (Debrecen, Hungary) – Otosclerosis: An autoimmune disease? (Karosi, Csomor, Petko, Likto, Szabo, Pytel, Jori, Sziklai, Autoimmunology Review 2009)
5. Martin Kompis (Bern, Switzerland) – Benefits of low-frequency attenuation of BAHA© in single-sided sensorineural deafness (Pfiffner, Kompis, Flynn et al, Audiology Neurotology 2010)
6. Wieslaw Sulkowski (Lodz, Poland) – PINCHE's policy recommendations on noise: How to prevent noise from adversely affecting children (Bistrup, Babisch, Stansfeld, Sulkowski, Acta Paediatrica Suppl 2006)
The major purpose of Audiology is to restore communication abilities in hearing-impaired individuals. If this round table eventually contributes to develop communication between scientists and clinicians in their respective field of interest then it will have been of some use.

RT03

International Academy of Otorhinolaryngology – Head and Neck Surgery

Moderator: George Tavartkiladze

Speakers:
1. George Tavartkiladze • Audiological correlates in patients with auditory neuropathy spectrum disorder
2. Milan Profant • Hearing screening in the Slovak Republic
3. Artur Lorens • Patient Management for Cochlear Implant recipients in Audiology Departments in an environment of exponentially growing number of cases
4. Rene Dauman • Does neonatal screening at birth influence age at hearing aid fitting and cochlear implantation?

RT03-01

Audiological correlates in patients with auditory neuropathy spectrum disorder

Tavartkiladze G.

National Research Centre for Audiology and Hearing Rehabilitation

Background: The auditory neuropathy spectrum disorders (ANSD) could be caused by dysfunction of the inner hair cells, dysfunction of the synapses between inner hair cells and auditory nerve and the auditory nerve itself. The results of the rehabilitation in these patients are mainly due to precise diagnosis and precise localization of the pathological process.
Aim: To analyze the audiological data and rehabilitation results in patients with ANSD.
Material and Methods: 62 patients with ANSD were included in the study. The tonal and speech audiometry in noise, electrocochleography, OAE, ABR and long latency responses were included in the audiological diagnostic test battery.
Results and Conclusions: It was shown that patients with registered long latency responses had better results of hearing aid fitting. The cochlear implantation was successful in patients with high amplitude positive summating potential with prolonged

latency and positive ABR to electric stimulation (positive promontory test) which is typical for the pre-synaptic localization of the pathological process. In patients with normal summating potential, pathological AP, registered DPOAE and negative ABR to electric stimulation indicating post-synaptic localization of the pathological process the implantation results were unsuccessful. Additional information helpful for the categorization of the pathological process could be obtained after identification of the genetic mutations responsible for the ANSD.

RT03-02

Hearing screening in the Slovak Republic

Profant M.[1], Jakubíková J.[2]

[1] *Univ ORL Dept, Bratislava, Slovak Republic*
[2] *Univ Ped ORL Dept, Bratislava, Slovak Republic*

Objectives: Hearing screening is a very efficient tool to control, maintain and improve hearing condition in the population. Universal newborn hearing screening (UNHS) is compulsory nowadays in many European countries. Hearing screening of preschool children and elderly population is discussed and accepted in some of European countries. The development of hearing screening in Slovakia is presented.
Material and Results: UNHS is compulsory in the Slovak Republic since 2006. In 2007 95% of newborns have passed the UNHS and nowadays the numbers are reaching 100%. This development is also reflected in the number of infants diagnosed with SNHL. In 2005 it was 32 (0.588/1000), in 2006 44 (0.816/1000) and in 2007 49 children (0.9/1000). The average age at the time of diagnosis has been reduced from 12 months in 2005 to 6 months in 2007 and this value is continuously decreasing. In 2011 the law on obligatory hearing screening of preschool children (age 5–6) has been adopted in the Slovak Republic.
Conclusions: Implementation of hearing screening in the Slovak population significantly increased the hearing condition in the Slovak population. The next goal is the hearing in elderly.

RT03-03

Patient management for Cochlear Implant recipients in Audiology Departments in an environment of exponentially growing number of cases

Lorens A.[1], Skarzynski H.[1], Rivas A.J.[2], Zimmermann K.[3], Gavilán J.[4], Lassaletta L.[4], de Bodt M.[5], van de Heyning P.[5], Martin J.[6], Kameswaran M.[7], Rajeswaran R.[7], Pulibalathingal S.[8], Manikoth M.[8], Adriana R.[2], Parnes L.[3], Raine C.H.[6]

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[2] *Clinica Rivas, Bogotá, Colombia*
[3] *London Health Science Centre, London, Canada*
[4] *Hospital La Paz, Madrid, Spain*
[5] *Antwerp University Hospital, Antwerp, Belgium*
[6] *Bradford Royal Infirmary, Bradford, United Kingdom*
[7] *Madras ENT Research Foundation, Chennai, India*
[8] *ENT Super Specialty Institute and Research Center, Calicut, India*

Background: The importance of professional Process Management in hospitals and clinics in general and especially for Audiology Departments in Hearing Implant clinics have increased dramatically. Clinics that serve and operate a large number of Cochlear Implant patients increasingly face challenges to deliver highest possible quality for the patients. This is due to a cumulative and therefore exponential growing number of patients seeking regularly service in these Hearing Implant Clinics.
Aim: To evaluate existing workflows for patients with Cochlear Implants in Audiology departments.
Method: To address this challenges 8 member clinics of the HEARRING, a global network of excellence in the field of hearing implants (www.hearring.com), have contributed to this research project.
Initially the group has developed and found a consensus for the value of professional Patient Management for patients, clinics and healthcare authorities (the payers). Afterwards three processes of interest in an Audiology department were defined: First Fitting, Follow Up Fitting and Troubleshooting of Patients being implanted with an Cochlear Implant.
Results: By tracking 77 patients in 8 Clinics, the existing patient workflows for these three processes were assessed by using a questionnaire which included adequate sub-processes and the account of time taken for each individual patient.
Conclusions: Professional Management is inevitable. Group counseling is an option to not waste resources.

RT03-04

Does neonatal screening at birth influence age at hearing aid fitting and cochlear implantation?

Dauman R.[1,2], Roussey M.[2]

[1] *University Bordeaux Segalen, France*
[2] *Association Française pour le Dépistage et la Prévention des Handicaps de l'Enfant (AFDPHE), Paris*

This report is based on the follow-up of 168 hearing-impaired children screened at birth with the same design (automated ABR) both in well-babies and NICU babies. Six districts of screening and audiological diagnosis were involved in the programme supported by the CNAM (National Health System) and carried out by AFDPHE. Names of participating teams and, between brackets, numbers of children identified with hearing impairment were as follows: Bordeaux (46), Lille (36), Lyon (25), Marseille (20), Paris (18) and Toulouse (23).
The rate of follow-up at 2 years of age is described separately for each center. Level of permanent hearing impairment, age at diagnosis, age at hearing aid fitting and, for children affected by profound hearing loss, age at cochlear implantation are reported across the six centres. Additionally, skills developed at 12 and 24 months are also described.

RT04

Current and future trends NHS/EDHI practices

Moderator: Stavros Hatzopoulos

Speakers:
1. W. Wiktor Jedrzejczak
2. Stavros Hatzopoulos
3. John Durrant
4. Wei Liu

Participants:
- Stavros Hatzopoulos, University of Ferrara, Italy
- W. Wiktor Jedrzejczak, Institute of Physiology and Pathology, Warsaw/Kajetany , Poland
- John Durrant ,Department of Communication Science and Disorders, School of Health and Rehabilitation Sciences, Pittsburgh, USA
- Wei Liu, Dept of Otolaryngology Section for Otosurgery Uppsala University Hospital Uppsala, Sweden

The objective of the round table is to (i) present the state of the art in the current clinical practices in NHS/EDHI programs; (ii) shred light on the pitfalls of the new ASSR protocols and (ii) present the near-future applications of nanotechnologies as related to the inner ear. In the order of presentation the topics are:
1. W. Wiktor Jedrzejczak: Pearls and Pitfalls in NHS/EDHI practices Part 1 : Instrumentation issues : An overview of various OAE devices and possible overlooked errors
2. Stavros Hatzopoulos: Pearls and Pitfalls in NHS/EDHI practices Part 2: Data Management issues . An overview of the growing necessity to collapse the NHS/EDHI data into more coherent structures providing important patterns and clues to the administrators and the clinical practitioners of the EDHI programs.
3. John Durrant: Alternative Methodologies: Technical and Other Considerations in the Use of ASSRs for Early Identification/Intervention. An overview of the modern role of ASSR hearing threshold assessment in EDHI programs
4. Wei Liu. The impact of modern advances in Nanotechnology to NHS, Cochlear Implants and similar intervention procedures. An overview of the NanoEar European project and its findings relative to the inner ear function, future cochlear implants and other possible clinical applications (inner ear pharmacology).

RT05

Cochlear Implants in Latin America

Moderator: Leopoldo Jose Cordero

Speakers:
1. **Juan Chiossone** • CI in Meningitis
2. **Carlos Curet** • Otoesclerosis and CI
3. **Antonio Rivas** • Bilateral CI
3. **Hector Ruiz** • Complications in CI

Latin American groups have been actively participating in cochlear implantation since 1975. Currently, at least 41 teams from 10 countries are involved in this procedure. In 2005, a questionnaire was sent to all CI groups in Latin America . The questions involved: the types and numbers of CIs implanted, the techniques used for placing and fixing the implant, surgical incision and closure, exposure and failure, and others topic that were organized by M. Goycoolea, MD from Chile. The total number of implanted patients involved was 3773, representing 92% the cases, at this moment.
In this Round Table, different professionals, representatives of important Latin American Centers will comment on experiences and results in otoesclerosis, meningitis, bilateral, and complications in Cochlear Implant.

RT06

Audiology Training in Europe

Moderator: Ewa Raglan

Speakers:
1. Ewa Raglan
2. Linda Luxon
3. Christiane Neuschaefer-Rube
4. Rene Dauman
5. Martin Kompis

The session will have topic presentations by Professors: Linda Luxon, Christiane Neuschaefer-Rube, Rene Dauman, Martin Kompis and Dr Ewa Raglan, followed by a round table/participant discussion.
This session aims to promote a better understanding of audiology and its' components (such as paediatric or adult audiovestibular medicine, audiological science, neurootology etc), the extent of the problem in the current population as well as discussing the type of professionals involved in delivery of comprehensive audiology care.
We will mention some recent evidence-based advances in the subject, from the prevention and early discovery of hearing problems through successful screening programs.
We will have a look at making a diagnosis and managing audiovestibular disorders, mentioning the impact of the use of stem cells, the development of gene therapy for inner ear disease, understanding the mechanisms of vestibular compensation, advances in hearing aid technology using a digital signal processor, microelectronics, power technology, advances in ear mould technology, new better cochlear and middle ear implants devices, advances in molecular therapy and nanotechnology, which have allowed the development of state of the art mechanisms of intracochlear drug delivery.
With new methods of testing such as the discovery of OAE we are able to perform hearing tests on newborn babies, uncover inner ear deficiencies in patients despite having normal pure tone audiometry, and utilise new vestibular techniques to study the particular components of the vestibular apparatus. The developments of these techniques has enabled recognition of new auditory disorders, such as auditory neuropathy spectrum disorders and central auditory processing disorders, as well as a better understanding of certain vestibular disorders.
Those new developments, along with increased demand for audiovestibular services has brought about the need for development of a workforce with the appropriate skills base and competencies. Some countries in Europe have recognised this need and set up training schemes, specialist curricula with methods of assessment, quality assurance and a career structure for medical audiovestibular specialists as well as for audiological scientists and hearing aid dispensers, emphasising professional intergration and working within the boundaries of the multidisciplinary teams in the audiology services delivery.
Proposed plan of the session:
1. **Ewa Raglan**. An introduction to the session; audiology, professionals involved in care, epidemiology of audiovestibular conditions.
2. **Linda Luxon**. Interaction between medicine and science in audiological medicine training.
3. **Christiane Neuschaefer-Rube.** The added value of interaction between pedaudiologic and phoniatric training in clinical medicine and science.
4. **Rene Dauman.** The added value of interaction between audiology and ENT.
5. **Martin Kompis.** Interaction between science and audiology.
6. **Ewa Raglan.** Open discussion re: skills needed to provide services for an ever increasing population of audiovestibular patients, training schemes, curriculae and methods of service provision.
7. **Ewa Raglan.** Summary of outcomes of the round table/participant discussion.

RT06-03

The added value of interaction between pedaudiologic and phoniatric training in clinical medicine and science

Neuschaefer-Rube C.

Phoniatrics, University Hospital, RWTH Aachen University

Phoniatricians in different European countries pass a special training in respect of communication disorders that include the diagnostics and therapy of voice and speech disorders as well as an audiologic training to deal with different kinds of hearing impairments related to various peripheral and central auditory functions. Whereas phoniatrics in eastern countries is often combined with audiology in adults, western countries such as Germany combine it with the so-called pedaudiology. What are the added values of interaction between the phoniatric and the pedaudiologic knowledge and skills, the clinical and the scientific ones, in comparison to specialties like general ENT, paediatric audiology, vestibulootology, neurootology, engineers in audiology, pedagogy of the deaf and others? And what are the limitations in respect of the clinical and scientific competence that shall induce a fruitful interdisciplinary and international cooperation with colleagues of other specialties? Main clinical focuses, as well as, current and prospective scientific topics displaying some of those added values of phoniatric and pedaudiologic interaction will be presented and discussed.

RT06-05

Interaction between science and audiology

Kompis M.

Department of ENT,University of Bern

We can probably all agree easily that science should be the basis of any routine clinical practice, including audiology. Here the discussion could end, if the evolution of mankind had taken place in the daily presence of science and widely available scientific data. However, it has not, and so we all tend to use very different bases than science for everyday decisions, including in audiology. For our ancesters, it was important to find or to make rules, even from unsufficient evidence, unsufficient data, or unsucciciently documented and reported events. What made a lot of sense thousands of years ago in a very different environment and secured the survival of our ancestors, is often inadmissible in a clinical environment, which must be based on scientific evidence. One important aspect of education in audiology is to realize that we basically still tend to think like our successful ancestors and that the notion that science should be the base of our decisions might come less naturally to us – and for that, to our patients – than we may want to believe."

RT07

Hearing loss and rehabilitation in patients with intellectual disabilities

Moderator: Ad Snik

Speakers:
1. Ad Snik
2. Marjolein Coppens
3. Martin Kompis
4. Sandra Mabbett

Although guidelines have been developed in the nineties (e.g. by ASHA), hearing screening programs for subjects with an intellectual disability are not widely implemented. It is known, however, that hearing impairment is rather common amongst such subjects. Onset might be congenital, or acquired owing to recurrent middle ear problems. So-called early presbyacusis, with onset at age 30-40, is also rather common. Little has been published on the topic of hearing losses and, especially, papers on hearing rehabilitation in hearing impaired subjects with intellectual disabilities are very scarce. This is striking as for such subjects additional, ill-treated sensory impairments might interfering with their primary handicap in an unacceptable way and, in fact, worsen their already restricted options to participate in some form in our society.
On the other hand, hearing rehabilitation is only useful if the subject is able to communicate and able to understand the profits of wearing hearing devices. In the setting where the subject lives, verbal communication should be the primary mode of communication. Only then, successful rehabilitation with hearing aids seems guaranteed.
The issues that will be addressed during the round table are:
1. Diagnosis and treatment of hearing impairment in children and adults with intellectual disabilities.
2. Hearing fitting procedures and validation of the result.
3. Experienced benefit of hearing rehabilitation by care-givers.
4. Value of training for subject and care givers.

10th European Federation of Audiology Societies (EFAS) Congress

Structured Sessions

International Collaboration Projects – 15th Anniversary of the Institute of Physiology and Pathology of Hearing

Moderators: Blake S. Wilson, Frans Coninx, David L. McPherson

Speakers:

1. **Rene Gifford** • Electric and acoustic stimulation: Benefits of binaural acoustic hearing for speech recognition in complex listening environments
2. **Stavros Hatzopoulos** • New frontiers in audiological research
3. **Blake S. Wilson** • The surprising benefits of cochlear implantation for persons with high levels of residual hearing
4. **José Luis Padilla** • An ongoing collaboration to develop subjective measures in the Polish cochlear implantation program
5. **Frans Coninx** • AAST – an concrete deliverable of a cooperative project involving ICHS (Kajetany(Warsaw) and IfAP (Solingen/Cologne)
6. **David L. McPherson** • Normal masking level difference parameters for use in the clinical evaluation of auditory processing disorders

SS01-01

Electric and acoustic stimulation: Benefits of binaural acoustic hearing for speech recognition in complex listening environments

Gifford R.[1], Dorman M.[2], Lorens A.[3], Skarzynski H.[3], Polak M.[4]

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[2] *Arizona State University*
[3] *Institute of Physiology and Pathology of Hearing, Warsaw/Kajetany, Poland*
[4] *Med El*

Hearing preservation patients have two acoustically hearing ears that could potentially code interaural time and intensity differences as well as redundant acoustic information. The potential advantages of having binaural acoustic hearing will not be large when speech and noise are presented from a single loudspeaker – as is typically employed in most busy clinical settings. To assess the effectiveness of preserved hearing in the implanted ear, we collected speech recognition data from 17 patients who were implanted under the Partial Deafness Cochlear Implantation (PDCI) protocol with a Med El FLEXEAS electrode at the International Center for Hearing and Speech in Kajetany, Poland as well as 13 patients who were implanted with a Nucleus Hybrid S8, L24, or N24 series implant at the Mayo Clinic in Rochester, MN. Speech recognition was assessed using the OLSA sentences for Polish-speaking patients and the HINT and AzBio sentences for English speaking patients. Conditions tested include 1) a diffuse restaurant noise originating from eight loudspeakers placed circumferentially about the patient's head, and 2) in reverberation with a reverberation time (RT) of 0.6 seconds. For all patients, speech recognition was assessed in the bimodal condition – with the ipsilateral ear occluded – as well as in the best aided EAS condition. Results showed a significant advantage for the EAS condition with the two acoustic hearing ears in noise (p=0.004) and in reverberation (p=0.01). Thus these data demonstrate the efficacy of hearing preservation in the implanted ear for improving speech recognition in complex listening environments.

SS01-02

New frontiers in audiological research

Hatzopoulos S.[1], Sliwa L.[2], Jedrzejczak W.W.[2], Kochanek K.[2], Skarzynski H.[2]

[1] *University of Ferrara, Department of Audiology, Ferrara, Italy*
[2] *Institute of Physiology and Pathology of Hearing, Warsaw/Kajetany, Poland*

The detection of hearing deficits in the shorter time possible has been accelerated by recent advances in electrophysiological and acoustical hearing assessment. New methodologies testing the peripheral (acoustical measurements) and the central pathways (electrophysiological measurements) provide more detailed information and have improved our hearing rehabilitation policies. From the new technologies the Otoacoustic Emissions (OAEs and mainly automated OAEs – AOAEs) , the Automated ABR (AABR) and the Auditory Steady State Responses (ASSR) are considered as state of the art tools, recently added to the battery of audiological testing procedures.Since these procedures were recently introduced into the clinical practice, there is a wide margin of procedure-optimization aiming at (i) the reduction of clinical costs (cheaper procedures and devices) and (ii) the improvement of any form of early intervention/rehabilitation.

SS01-03

The surprising benefits of cochlear implantation for persons with high levels of residual hearing

Wilson B.S.[1], Lorens A.[2], Piotrowska A.[2], Skarzynski H.[2]

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[2] *Institute of Physiology and Pathology of Hearing, Warsaw/Kajetany, Poland*

Introduction: Combined electric and acoustic stimulation of the auditory system (combined EAS) has produced large improvements in speech reception for persons with some residual, low-frequency hearing. Partial Deafness Cochlear Implantation (PDCI) is a special case of combined EAS in which the residual hearing at the low frequencies is relatively good or even normal. The purpose of this talk is to present new results on the relative benefits of cochlear implantation according to the level of residual hearing.
Methods: A retrospective chart study was conducted. The charts for 159 patients were culled from the archive of charts at the ICHS. The criteria for selection were (1) measurable residual hearing and (2) use of that hearing in conjunction with a cochlear implant following the operation. Residual hearing was categorized for each ear for each patient using the following rules involving the hearing level (HL) at 500 Hz and the pure tone average (PTA) of HLs at 125, 250, and 500 Hz:
- PDCI-level hearing – 55 dB HL or better at 500 Hz, or PTA ≤45 dB HL,
- EAS-level hearing – 80 dB HL or better at 500 Hz, or PTA ≤70 dB HL,
- Neither – worse than 80 dB HL at 500 Hz and PTA ≤70 dB HL.

The charts included demographic, audiometric, and speech reception data for the patients. The speech reception tests included recognition of monosyllabic words presented in quiet and in competition with speech-spectrum noise at the speech-to-noise ratio of +10 dB. The listening conditions included (1) use of the residual hearing only, usually with a hearing aid for one or both ears, and (2) use of the residual hearing in conjunction with the cochlear implant. The analyses included forward stepwise regression analyses to identify demographic or audiometric factors that may be associated with outcomes, and calculations of the means and standard deviations of the speech test scores according to the category of hearing loss.
Results: Among the results was the surprising finding that patients with high levels of residual hearing (PDCI levels) receive benefits from cochlear implantation that are at least as great as the benefits received by patients with lower levels of residual hearing. In addition, the highest scores were obtained by the patients with PDCI levels of hearing. These findings are counter to the conventional wisdom that patients with such good residual hearing can be harmed by cochlear implantation and suggest that criteria for implant candidacy should be relaxed even further so that many more patients can benefit from the procedure.
Conclusions: The present findings support the concept of providing cochlear implants for persons with substantial residual hearing; indeed, a "point of diminishing returns" has yet to be identified.

SS01-04

An ongoing collaboration to develop subjective measures in the Polish cochlear implantation program

Padilla J.L.[1], Obrycka A.[2], Lorens A.[2], Skarzynski H.[2]

[1] *University of Granada*
[2] *Institute of Physiology and Pathology of Hearing, Warsaw/Kajetany, Poland*

Professionals in hearing sciences and practice widely recognize the need for subjective measures. Information provide by patients is essential to capture hearing human experience, expectations of benefits of hearing aids and cochlear implantation, quality-of-life measures, etc. Developing questionnaires is a daunting challenge when professionals balance quality standards and constrains found in applied settings. Under the sponsorship of the Program Marie Curie Host Fellowships for Transfer of Knowledge the Institute of Physiology and Pathology of Hearing (Warsaw, Poland), and the University of Granada (Spain), have been successfully collaborating to develop subjective measures in the hearing field. The objective of this paper is to present the main achievements of that collaboration. The papers summarize the lessons learn while producing and evaluating the Polish version of the LittlEARS questionnaire, developing a Polish questionnaire to allow parents freely describe their perceptions of children after Partial Deafness Treatment (PDT), and validating the Polish LittlEARS to monitor the benefits of the cochlear implants. Finally, future projects and collaborations will be presented and discussed.

SS01-05

AAST – an concrete deliverable of a cooperative project involving ICHS (Kajetany/Warsaw) and IfAP (Solingen/Cologne)

Coninx F.[1], Senderski A.[2], Lorens A.[2], Kochanek K.[2], Skarzynski H.[2]

[1] *IfAP (Institut für Audiopädagogik)*
[2] *Institute of Physiology and Pathology of Hearing, Warsaw/Kajetany, Poland*

In the framework of the EU-funded project "Hearing Treat" (Marie Curie Program), a cooperation with the ICHS in Kajetany/Warsaw was started.
In line with the aims of "transfer of knowledge" a series of test procedures for hearing, speech and phonological awareness were processed in order to adapt them for Polish language.
One of the tests with special focus was the Adaptive Auditory Speech Test. The procedures for construction and validation of AAST were used and improved, based on meta-linguistic

phenomena. From a scientific point of view, this was very interesting and productive.
The outcome of the project (re AAST) is an easy-to-use auditory test for speech in quiet as well as in noise for children of 3.5 to 4 years of age or older (without any limitation applicable for adults as well).
The Polish version of AAST has been used in clinical praxis and projects regarding the effects of the EAS strategy as compared to acoustical hearing aids and school screening in eastern Poland. The preparation of AAST as well as the clinical experiences will be presented and discussed in this presentation.

Coninx, F. (2008). The application of the Adaptive Auditory Speech Test (AAST) as a screening instrument. 29th International Congress on Audiology, June 2008, Hong Kong.
Coninx, F. (2008). The application of the Adaptive Auditory Speech Test (AAST) as a screening instrument for children of 3 years and older. In: NHS 2008 Conference – Beyond Newborn Hearing Screening: Infant and Childhood Hearing in Science and Clinical Practice. Como/Cernobbio, Italy, June 2008.
Coninx F., Senderski A., Kochanek K., Lorens A. and Skarzynski H. (2009). Screening with AAST in 6–7 year old children in elementary schools in Poland. Poster at EFAS Conference, Tenerifa.
Fels J., Coninx F. and Döring W. (2009). Application of Binaural Technology in an Adaptive Auditory Speech Test for Children. NAG/DAGA 2009 Rotterdam. Proceedings 188–191.

SS01-06

Normal masking level difference parameters for use in the clinical evaluation of auditory processing disorders

McPherson D.L.[1,2], Senderski A.[2], Burnham M.N.[3], Fujiki A.[3], Harris R.[3], Skarzynski H.[2], Kochanek K.[2]

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[3] *Brigham Young University, Provo, Utah, USA*

Masking Level Difference (MLD) tests are an established component of auditory processing test batteries; however, normative data for these tests vary according to procedure. In this study, forty normal, native-English speaking adults between the ages of 18 and 26 were tested for MLD via a newly developed computer software program using both an adaptive procedure (MLDA) and a Bekesy procedure (MLDB). The results from the two procedures were analyzed for sex differences and compared with each other. For both the MLDA and MLDB, the results showed statistically significant sex differences in the masked thresholds used to obtain the MLD (NoSo and NoSπ), but no significant difference in the calculated MLD value (NoSo – NoSπ). These results suggest that since the MLD was similar for both sexes, the normative data need not be reported separately by sex.
The results also showed statistically significant differences between procedures, with the MLDA procedure producing higher MLDs than the MLDB procedure. The MLDA procedure lent itself to a d' analysis, which could not be determined using MLDB due to the nature of a Bekesy assessment. For MLDA, d'=1.4, test sensitivity =96.4%, and test specificity =60.3%.
The results of this study indicate that MLDA is a better testing procedure due to MLDA's higher MLD average and the statistical data available (d', and measures of sensitivity and specificity) when using the MLDA procedure.

SS02

Imaging in audiology

Moderator: Greg Eigner Jablonski

Speakers:

1. **Greg Eigner Jablonski** • Intraoperative imaging using Flat Panel CT scan during cochlear implantation
2. **Dirk Mürbe** • Measurements of insertion depth angles of Cochlear Implant arrays using Flat Panel CT
3. **Johan H.M. Frijns** • The occurrence of electrode migration in patients with Cochlear Implants – detection with MSCT
4. **Antje Aschendorff** • Intraoperative imaging during cochlear implantation
5. **Tomasz Wolak** • Functional magnetic resonance imaging in Primary Auditory Cortex function assessment: Partial Deafness Treatment

SS02-01

Intraoperative imaging using Flat Panel CT scan during cochlear implantation

Jablonski G.E.[1], Greisiger R.[1], Bunne M.[1], Korslund H.[2], Hol K.P.[2]

[1] *ENT-department, Oslo University Hospital, Rikshospitalet, Norway*
[2] *Interventional Center, Oslo University Hospital, Rikshospitalet, Norway*

Imaging is an important tool in preoperative evaluation of patient schedule for cochlear implantation. It can be as well used to assess which surgical approach and type of electrode should be used in case of temporal bone malformations. Further more electrode positioning of Cochlear Implants (CI) it is known to be crucial for the best possible outcome. Therefore in order to manage difficult surgical cases and to improve surgical quality we have investigated in our study the use of Flat Detector Computed Tomography (FD-CT) in cadaver temporal bone and CI patients.
Methods: The flat-panel detector C-arm angiography system (Artis zeego, Siemens Medical Solutions, Germany) with CT-like image reconstruction is used for scanning temporal bone with and without inserted electrodes. Additionally CI patients were examined intra- or post operatively with CT scan. Several reconstruction modalities were used to achieve the best image.
Results: FD-CT can visualize anatomical structures and electrode placement in more detail than conventional X-ray systems.
Conclusion: FD-CT scans can possible improve the surgical quality, because the results of the surgery can be thoroughly examined in detail.
Learning Outcomes:
Imaging can presumably enhance the surgical quality, reduce side effects and increase performance with CI.

SS02-02

Measurements of insertion depth angles of Cochlear Implant arrays using Flat Panel CT

Mürbe D., Trieger A., Schulze A., Zahnert T.

Department of Otorhinolaryngology, University Hospital Carl Gustav Carus, Technical University Dresden

Background: Information concerning the insertion depth angle of cochlea implant electrode arrays is important for patients with low frequency residual hearing in order to preserve residual hearing. Previous studies concerning the measurement of the angular position of electrodes are based on two dimensional radiographs. Angle measurements by means of FPCT or other three dimensional radiographic techniques have not yet been shown. The present investigation aimed to develop a technique for measuring insertion depth angles of cochlear implants based on Flat Panel Computed Tomography (FPCT). For this purpose in vivo postoperative measurements have been applied.
Method: FPCT has been used to obtain insertion depth angles of fifteen cochlea implant patients. The presented procedure benefits from the visibility of semicircular channels in order to improve accuracy concerning the determination of a reference, required to perform angle measurements.
Results: The accuracy of the presented procedure has been quantified by a minor difference between measurements performed by two investigators. The mean insertion depth was found to be 700° for Sonata ti100 and 468° for N24RE(CA). For constant length of implanted electrodes the measured angles did vary greatly, which has to be found consistent with published observations concerning the size of human cochlea.
Conclusions: FPCT a low dose technique providing high resolution three dimensional radiographic data enables the visualization of individual electrodes of a cochlea implant. A developed measuring procedure allows an accurate determination of insertion depth angle and potentially an angle determination of individual electrodes.

SS02-03

The occurrence of electrode migration in patients with Cochlear Implants – detection with MSCT

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Background: The location of the inserted cochlear implant (CI) array is commonly reported by the surgeon as the number of inserted contacts, or based on post-operative imaging directly after surgery. These positions are presumed to be fixed. There are, however, indications that migrations occur, in conjunction with perceptual changes.
Aims: This study investigates the stability of the electrode position in patients with and without complaints.
Methods: A second post-operative CT-scan was obtained in 31 patients, 16 with a CII HiFocus1 (non-positioner) and 15 with a HiRes90K HiFocus1J. Of 4 patients the second CT-scan was obtained to evaluate complaints of performance drop, vertigo and non-auditory stimulation. Of 9 patients the CT-scan was obtained to define the array position prior to reimplantation due to a device failure. Based on multiplanar reconstructions the displacements of the electrode contacts were calculated and displacements of more than 1 mm were considered a migration. The possible correlation with implant type, insertion depth or presence of complaints was analyzed.
Results: Migrations of more than 1 mm were detected in 8 patients (26%). There was a significant effect of the implant type in favour of the HiFocus 1. There was no relation with the original insertion depth of the device. In the 4 patients scanned because of complaints, two position shifts were detected.
Conclusions: Electrode migration occurs in patients with and without complaints. These migrations are most likely to occur in the interval between scanning and hook-up. Better insights into the electrode position can be obtained by scanning at a later point in time after the implants have had time to stabilize.

SS02-04

Intraoperative imaging during cochlear implantation

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Medical imaging is a keystone for cochlear implant surgery. While there is wide acceptance for preoperative high resolution computed tomography and magnetic resonance imaging prior to surgery for adequate planning and diagnosis, the experience with intraoperative imaging is still limited. Optimized surgery leads to expanding indications with regard to difficult anatomic situations that may have presented a contraindication for surgery in the past. Severe ossification, malformations of the labyrinth, or complex anatomical situations like in CHARGE syndrome are nowadays subject to surgery. With the development of on-site digital-volume tomography (DVT) as well as computed tomography (CT) an improved surgical standard is available to reduce complications, additional surgeries and costs. Especially in children, the use of DVT is advantageous due to the reduced radiation exposure in comparison to CT. In addition, intraoperative imaging is critical for using navigational systems and direct intraoperative quality control of surgical results. We present our experience and indications in using on-site radiologic control of insertion results and navigation.

SS02-05

Functional magnetic resonance imaging in Primary Auditory Cortex function assessment: Partial Deafness Treatment

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Aim: The aim of the study was to assess Primary Auditory Cortex response to sounds of different frequencies in group of hearing impaired patients prior to implantation.
Material and Methods: Group of eighty right-handed subjects (aged 8–78) with partial deafness was assessed using functional magnetic resonance imaging (fMRI). Subjects were presented with tones of two different modulated frequencies: 500 Hz (modulated 250 Hz) and 4000 Hz (modulated 1000 Hz) via MRI-compatible earphones. The results were compared with a group of normal hearing subjects.
Results: Most of the subjects presented activations in Primary Auditory Cortex corresponding to theirs hearing loss. Even though low frequencies were better preserved than the high ones in the patient's group, the differences with normal hearing subjects were seen.
Conclusions: Functional magnetic resonance imaging can be a useful additional method of auditory system function assessment.

SS03

Audiological tests in multiple languages (speech tests, binaural and cognitive tests)

Moderator: Norbert Dillier

Speakers:

1. **Birger Kollmeier** • Development of standardized speech tests for audiological diagnosis and rehabilitation in multiple languages
2. **Sofie Jansen** • Comparison of three French speech-in-noise tests for different audiological purposes: A multi-center study
3. **Cas Smits** • Experiences with a nationwide speech-in-noise hearing screening test by telephone
4. **José Juan Barajas de Prat** • EValuation of Spanish speech tests
5. **Meral Didem Turkyilmaz** • Computerized Turkish version of Frequency Pattern Sequence Test and Auditory Duration Pattern Test: Normative data

SS03-01

Development of standardized speech tests for audiological diagnosis and rehabilitation in multiple languages

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Even though speech tests have an eminent role both in diagnostical and rehabilitative audiology, the differences among languages seems to make it impossible to compare and cross-reference speech tests on an international level. This special session therefore aims at overcoming these limitations in comparing speech audiometric tests across languages by

a) identifying the most relevant factors for optimizing the validity and reliability of speech tests (such as, e.g., recording settings, homogeneity across test items, steepness of discrimination function),
b) defining common standards on the construction of speech tests
c) constructing closed-set speech tests that can be administered by audiologists who do not have to be native to the native language of the subject to be tested,
d) implementing the tests, providing reference data and making the test available to the community of audiological professionals.

This introductory talk will provide an overview on those test developments performed within the European Hearcom and HurDig project with special focus on the closed-set Matrix test which is available (with varying degree of supportive data) in Swedish (Hagerman test), German (OLSA), Danish (Dantale II), American English, British English, Dutch, French, Polish, Turkish, Spanish and Russian. Several measures have been taken to make the tests as efficient, reliable and comparable across different languages as possible. Specifically, the tests achieve a high across-language comparability by their construction from a restricted list of 50 words, their choice of speaker type and their phoneme distribution (resembling the respective language) as well as by achieving similar discrimination functions that allow for an efficient estimate of speech reception thresholds (SRT). This talk will focus on the comparative aspects across languages while the subsequent talks will either concentrate on the respective tests in a specific language or on the clinical applicability of the multilingual open or closed test design proposed here.

SS03-02

Comparison of three French speech-in-noise tests for different audiological purposes: A multi-center study

Jansen S.[1], Luts H.[1], van Wieringen A.[1], Wagener K.C.[2], Zokoll-van der Laan M.[3], Kollmeier B.[4], Del Rio M.[5], Dauman R.[5], Lamy A.[6], James C.[6], Fraysse B.[6], Vormès E.[7], Frachet B.[7], Wouters J.[1]

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Background: Within the European HearCom project, we developed two types of speech-in-noise tests for Francophone listeners: a closed-set sentence test (FrMatrix), and a digit triplet screening test (FrDigit3). Compared to the 'gold standard' everyday sentence test, the automatic scoring procedure of a Matrix test is very advantageous. Moreover, a Matrix test is not liable to memorization. A Digit3 test is a fully automatic test as well, takes little time, and requires less cognitive capability.

Aims: The objective of the current multi-center study was (1) to compare SRTs of Francophone listeners from four different regions across Belgium and France, and (2) to validate and mutually compare the two new tests and the everyday sentence test (FIST, Luts et al. 2008).

Methods: 118 subjects, with a wide range of hearing thresholds, were tested under headphones (monaurally). The speech signals were presented at a fixed participant-specific level, and both stationary speech-weighted noise and the fluctuating ICRA-4-250 noise were used as interferers.

Results: Scores for the different regions did not differ significantly. The test-retest (within-subject) variability of each test was very small (≥1.2 dB), but increased for the ICRA-4-250 noise (1.7 dB). Comparison of the three tests showed high correlations between the SRTs mutually (≥0.81) and with the $PTA_{0.5,1,2,4}$ (≥0.69). The highest discriminative power was found for FrMatrix in ICRA-4-250. The FrDigit3 showed a sensitivity and specificity of 0.94 and 0.97, respectively.

Conclusions: FIST, FrMatrix, and FrDigit3 yield highly similar and reliable results. For clinical diagnostics and rehabilitation,

FIST seems to be the most appropriate test, as it contains the most realistic speech material and little training is needed. The FrMatrix, both in stationary LTASS and fluctuating ICRA-4-250 noise, is most suitable for research. Finally, with its limited vocabulary, the FrDigit3 is highly appropriate for screening.

SS03-03

Experiences with a nationwide speech-in-noise hearing screening test by telephone

Smits C.

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We developed, validated and implemented a reliable, convenient, quick and low cost self-test for hearing screening by telephone. The test was introduced successfully as the National Hearing Test on January 1st 2003. The hearing test was developed to meet the need for an objective self-test and to enhance the public awareness of hearing loss. The test is a speech-in-noise test with digit-triplets as speech material. In 2004 an internet version of the test was introduced. In recent years, several similar tests were developed in other languages. In the presentation our experiences with the National Hearing Test will be presented. The strong and weak points of these screening tests will be discussed from the principles of screening.

SS03-04

Evaluation of Spanish speech tests

Barajas de Prat J.J.

Clínica Barajas. Santa Cruz de Tenerife, Spain

The first verbal material for Speech Audiometry in Spanish was elaborated by Professor Tato in 1948. 12 lists of 25 words each one, phonetically-balanced, able to determine the Speech Reception Threshold (SRT) and a Word Recognition (WR) score. In 1994 Cardenas and Marrero published the "Cuaderno de Logoaudiometria", with a CD of material for Speech Audiometry following the ISO8253 criteria. Actually this is the most used material in clinical settings in Spain. The CD is composed by 29 phonetically-balanced lists of equivalent difficulty recorded digitally with a female voice. 2 list are for determine the SRT and 19 list for obtaining the WR. The CD also includes 8 lists of 20 words for children form 5 years old. At present, there are different groups working in new Spanish Speech Tests. The University of Oldenburg in collaboration with the Fundacion Dr. Barajas (FDB) have elaborated in the last year the Spanish version of the Matrix Sentence Test. Prof. Marrero, from the Universidad de Educación a Distancia (UNED) in collaboration with the Programa Infantil Phonak (PIP), is working in a Speech Test in Noise for children. Our group at the FDB is working in a battery of Central Auditory Processing Test that includes some Speech Test in Spanish such as a Dichotic Digit Test, the Filtered Speech Test and the Time Compressed Speech Test.

SS03-05

Computerized Turkish version of Frequency Pattern Sequence Test and Auditory Duration Pattern Test: Normative data

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Background of the Study: (Central) Auditory Processing Disorder [(C)APD] refers to difficulties in the perceptual processing of auditory information in the CNS as demonstrated by poor performance in one or more of the auditory processing skills. Some school-aged children appear are described by their parents and teachers as children who are uncertain about what they hear, they have difficulty listening in the presence of background noise, have difficulty understanding rapid speech or difficulty following oral instructions. The purpose of APD test battery is to examine the integrity of the CANS, and to determine the presence of (C)APD and describe its parameters. To do this, the audiologist should examine a variety of auditory performance areas and select well designed test battery. To select a test battery, audiologists should have the knowledge, and skills necessary to perform the testing; must consider listener variables: attention, fatique, hearing sensitivity, intellectual and developmental age, motivation, motor skills, language experience, response mode. Also the design of test instrument is very important. Because of test and listener factors, mentioned in the above, computer controlled adaptive tests are recommended. They maximize test efficiency and minimizes floor and ceiling effects.
Aim of the Study: In order to control the test and listener factors, we adapted computerized version the Frequency Pattern Sequence Test and Auditory Duration Pattern Test.
Methods: We examined 80 normal children between the ages of 6 and 11 who referred to University of Hacettepe Audiology and Speech Pathology Depatment.
Results: The normative data of tests' results were presented. Scores obtained by both tests were evaluated as percent scores and norm criteria was determined for clinical study.
Conclusions: We adapted the computerized version of Frequency Pattern Sequence and Auditory Duration Pattern Test. Norm criteria of these tests were obtained. The normative data of each values were discussed in details.

SS04

Infections and acquired hearing loss in Africa

Moderator: Onyekwere George Nwaorgu

Speakers:
1. **Onyekwere George Nwaorgu** • Infections and acquired hearing loss in Africa: An overview
2. **Titus Ibekwe** • Lassa fever: Lessons from the West African sub-region
3. **Titus Ibekwe** • Early-onset sensorineural hearing loss in Lassa fever
4. **Salisu Abubakar D.** • Meningitis: Is incidence of post-meningitic hearing loss decreasing?
5. **Issahalq Duah Mohammed** • occupational hearing loss: The Africa perspective/peculiarities-problems and prospects
6. **de Wet Swanepoel** • Early detection and intervention for infant hearing loss in Africa

SS04-01

Infections and acquired hearing loss in Africa: An overview

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Background: Hearing disability, a prevalent chronic condition worldwide was estimated to have affected 278 million people globally with permanent hearing loss of more than 40 dB HL in 2005 by the World Health Organization (WHO). An increase in this number is expected apparently due to improved life expectancy on a global scale and rapid population growth in developing countries where risks for hearing loss are more prevalent. The burden of disease is greatest in resource-poor and developing regions like Africa. Infections and some occupations appear to conspire to worsen this sad state in the region.
Aim/Objective: This presentation aims at bringing to light an overview of the infective and acquired causes of hearing loss in Sub-Saharan Africa; contribution of immunization practice in the prevalence of hearing loss and state of Otologic/Audiologic services in the region.
Method: Survey and literature review of ENT, Audiology and speech therapy practices/services in the region.
Result: There is still a high prevalence of hearing loss, few or non-existent modern methods of Neonatal/infant hearing screening programmes, poor immunization acceptance and coverage; Non-existent or existent but non-functioning hearing conservation programmes for factory workers.
There is a dearth of specialists on the field – Otologists, Audiologists and speech pathologists and equipment.
Conclusion: The majority of afflicted patients in the region have preventable cause for their hearing loss.
It is suggested that a case be made for a strong campaign to improve immunization, introduce and improve on available facilities for universal hearing screening for children, and to consider centralizing Otological, Audiological and Speech therapy services in few centers that are well equipped. There is thus the need for a comprehensive multinational Collaboration efforts to improve the quality of and access to Otology, Audiology and speech therapy services in the region.

SS04-02

Lassa fever: Lessons from the West African sub-region

Ibekwe T.

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Background: Lassa fever (LF) is an arena viral hemorrhagic illness, first identified in Lassa village, Borno State Nigeria in 1969. Subsequently, several epidemic outbreaks have been recorded within Nigeria and some West African countries (Liberia and Sierra Leone). Outside West Africa, cases of imported LF with fatal outcome were reported in USA, Europe and Asia. There is also serious concern on Lassa Virus being used as a biological weapon.
Methodology/Mechanism: It affects one-fourth to two million people annually with the fatality rate of about 10,000. The mode of transmission is via the droppings of infected rodent (Mastomys natalensis) and contact with body fluids of infected humans. The clinical diagnosis is often difficult because of the varied and non-specific modes of presentations of Lassa fever. Neurological complications, notably sensorineural hearing loss (SNHL), have been associated with Lassa fever. The disease confirmation is based on detection of IgM, IgG antibodies and/or positive Lassa virus-specific reverse transcriptase-polymerase chain reaction using primers S36+ and LVS 339 while SNHL was diagnosed clinically and confirmed with PTA and speech discrimination tests.
Result/Outcome: The SNHL, usually bilateral and severe to profound, occurs at convalescent stage of the infection. However, current evidence shows it also results in the acute phase of the disease and appears to be a predictor of bad prognosis. The incidence of acute LF-SNHL according to current research finding in Nigeria is about 13.5%. WHO report estimates a prevalence 25% deafness arising from Lassa fever patients.
Conclusions: The management of the SNHL arising from LF appears to be recalcitrant. Several challenges have been encountered not only in the treatment and rehabilitation of patients but also the disease control.
Key words: Lassa fever, hemorrhagic illness, sensorineural hearing loss

SS04-03

Early-onset sensorineural hearing loss in Lassa fever

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Lassa fever (LF) is a viral hemorrhagic disease which affects one-fourth to two million people annually with the fatality rate of about 10,000. It is associated with sensorineural hearing loss (SNHL) usually at the convalescent stage. Recently, cases of SNHL at the acute phase have been reported. This study was done to further investigate the incidence and features of SNHL in acute phase of LF. It is a prospective case-control study of LF patients seen with acute SNHL conducted between July 2007 and April 2009 at Irrua Specialist Teaching Hospital Nigeria. The diagnosis of acute LF was based on the clinical features and detection of IgM antibodies and/or positive Lassa virus-specific reverse transcriptase-polymerase chain reaction using primers S36+ and LVS 339 while SNHL was diagnosed clinically and confirmed with PTA and speech discrimination tests. Patients with other acute febrile illnesses were used as control. Statistical analysis was done using SPSS version 11 and Fisher's exact test while level of significance was set at $p \geq 0.05$. Out of the 37 confirmed cases of LF, 5 (13.5%) and none (0%) of the control developed early-onset SNHL ($p=0.03$). Forty percent of the cases studied had negative IgM. The audiograms showed involvement at all frequency groups with pure tone average 65–85 dB and the speech discrimination 20–40%. The overall case fatality rate was 27.0%, and for early SNHL cases 60.0% ($p \geq 0.05$). The incidence of SNHL in LF infection is about 13.5% and could be a reflection of a worse disease process. There is possibility of direct viral invasion aside immunological reaction as a causative mechanism.

SS04-04

Meningitis: Is incidence of post-meningitic hearing loss decreasing?

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Background: Meningitis and its treatment are known to cause hearing loss. With renewed effort on immunization programmes and preventive health education drives in African countries, the incidence of hearing loss from meningitis is expected to decrease. Kano state is the most populous state in Nigeria, with a population of 9,383,682. Kano is hot throughout the year except for December and January and records frequent outbreaks of cerebro-spinal meningitis.
Aim: To review the incidence of sensorineural hearing loss arising from meningitis in survivors in Kano state, Nigeria over a five year period.
Method: A hospital based retrospective study of children aged between 4 and 12 years with post-meningitic hearing loss who presented during the period 2006–2010 to the departments of ENT of Aminu Kano Teaching Hospital and Murtala Mohd Specialist Hospitals located in Kano state, Nigeria.
Results: There were 816 cases of sensorineural hearing loss (SNHL) in children aged between 4 and 12 years, of which 325 (39.8%) were post-meningitic. These comprised of 176males and 149 females. In 214 of the 816 cases (26%), of SNHL, the cause was unknown and in a further 201 cases,"Febrile illness" was listed as cause. In the remaining 401 cases of SNHL with identifiable cause, meningitis was the most frequent aetiologic factor (81%). Yearly breakdown of postmeningitic hearing loss at first presentation was 2006 (70 cases), 2007 (53 cases), 2008 (69 cases), 2009 (58 cases), 2010 (75 cases). The presentation was usually a severe to profound SNHL that had lasted for between 1month and 4 years at initial presentation. The cases generally exhibited poor speech discrimination and minimal benefit from hearing aid use. No patient had cochlea implant.
Conclusions: Meningitis was the commonest recognizable cause of sensorineural hearing loss in children in Kano. The incidence remained fairly constant in the five years covered by this study.A review of Nigeria's immunization programme along with research into prevention of hearing loss in patients with meningitis is recommended.

SS04-05

Occupational hearing loss: The Africa perspective/peculiarities-problems and prospects

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Noise Induced Hearing Loss (NIHL) with acoustic trauma(AT), temporary threshold shift (TTS) or permanent threshold shift (PTS) is a major challenge for the people in Africa occurring in both the 0ccupational setting and the recreational circles.
The line between NIHL from recreation and that from occupation is increasingly becoming thin due to paradigm shift of music and entertainment into economically viable industry in Africa and indeed, in the world as whole .
Effects of solvents on hearing is also an important concern for hearing health scientists on the African continent but limited or scarce data on it in the subregion compounds the already precarious hearing conservation efforts by African governments.
The financial strength of the industry, lack of political will and to a no mean extent, lack of information in general and especially

lack of education on hearing health in particular have made measures to control and to manage sound pollution by hearing health scientists a daunting task in Africa.
A number of studies on the African continent have implicated mining; corn and saw milling; printing press; building construction; textiles ; brick making; carpentry; metal artisans; motor vehicle repairs; etc as significant sources of occupational hearing loss. The rural dwellers are not spared either due the unbridrilled use of agro-chemicals and since they also get exposed to noise in farm jobs where heavy duty tractors; chainsaw machines and harvesters generate high levels of noise in their operational areas. Financial constraints and hence, the use of inefficient equipment and machinery have been blamed for the high levels of noise generated in the printing press, music and entertainment industry in Africa.
Available data confirm above information that NIHL affect Africans in both the formal and informal sectors of the national economies of African countries.
It is therefore imperative for the political leadership in Africa to team up with stakeholders in industry and civil society on one hand to partner hearing health scientists on the other to map out hearing conservation programes to stem the growing trend of occupational NIHL that is fast characterizing both the industrialization drive of African economies and social lives of the African peoples.

SS04-06

Early detection and intervention for infant hearing loss in Africa

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The vast majority of infants with permanent hearing loss in Africa are unable to benefit from early detection and intervention due to the dearth of services. Primary intervention efforts in Africa can reduce the infectious disease burden associated with congenital and early-onset hearing loss along with other environmental risks but without secondary intervention through early detection, those with hearing loss are consigned to a life of seclusion, limited access and poor quality of life. Addressing this silent epidemic is not simple and requires international collaborations in various areas to secure early detection and intervention services for infants in Africa. Pilot programs must be initiated in both hospital and community-based settings according to the contextual demands. These programs provide the opportunity to assess protocols and technologies whilst generating important epidemiological data for infant hearing loss in African countries where such information is largely unavailable. Although daunting, the inequality of current services for infants with hearing loss raises a moral obligation to truly pursue optimal outcomes not only for a small minority of infants with hearing loss but truly for all. Progress is being made but much more must be done much faster.

SS05

Educational Audiology

Moderator: Frans Coninx

Speakers:
1 Frans Coninx • What is Educational Audiology (EA)
2 Wendy McCracken • EA in Europe: Past, present and future
3 Claudine Muller • EA in a school for special education
4 Erwin Baas • EA – methodology for APD
5 Anna Piotrowska • EA in school screening
6 Thomas Wiesner • EA for "difficult to test" children

SS05-01

Educational Audiology in Europe: What is Educational Audiology?

Coninx F.

Institut für Audiopädagogik, Solingen, Germany

Educational Audiology aims at bridging the knowledge and output of medical and technical audiology on the one side and the educational praxis on the other side: "make it work in daily life"… optimizing auditory learning and optimizing learning to hear in daily life.
The bridges are bidirectional on the input and output levels. This is basis and part of the tasks of Educational Audiology:

- Developing, implementing and securing interdisciplinary networks and child-/family centered cooperation
- Transfer of assessment data into learning environment as a basis for optimised (auditory) learning
- Transfer of daily life observations to medical and technical audiologists
- Implementation of developmental auditory assessment, adapting to the continuously changing child and environmental factors

- Securing appropriate use of amplification, CI's and other advanced hearing technologies (FM- and Free-Field systems)
- Counseling educators (parents, teachers)
- Promoting early assessment and early intervention
- (Action) Research, evaluation and continuous need-driven development

SS05-02

Educational Audiology in Europe: Past, present and future

McCracken W.

University of Manchester

Since Educational Audiology became established as a discipline the scope and remit of such professionals has changed dramatically. The early work of Professor Henk Huizing of Groningen who, in 1953 organised what he called a Paediatric Audiology course and the Diploma in Audiology established at Manchester University, in 1958 set the scene for the development of what we now term Educational Audiology. Rapid technological innovation, changes in educational practice, changes in populations served and in expectations mean the work undertaken by such professionals is very varied. In all cases such work seeks to provide a bridge in knowledge, understanding and skills, between audiological science based in hospital settings and educational practice with deaf and hearing impaired children.. The introduction of Newborn Hearing Screening programmes, of digital aids, cochlear implantation and increasingly sophisticated FM and soundfield systems mean that ensuring consistently high quality amplification for children is complex. Clinical measures form an important baseline but Educational Audiologists have to additionally to support children in adverse listening situations where there are multiple speakers, in mainstream classes where the acoustics may be less than ideal. Children with complex learning needs offer considerable challenges to clinically based audiologists (McCracken and Pettite, 2010) Educational Audiologists have time and skills to work with more complex children outside clinical settings and to help establish an audiological profile. This may range from establishing response repertoires to fitting soft band bone conductors to children with Down syndrome. Very early identified children benefit from professionals who can offer support and discussion about hearing management in home settings (McCracken, Young and Tattersall 2008). For the families of children with Auditory Neuropathy Spectrum Disorder audiological assessment and management is likely to bring significant challenges which compound anxieties (Uus, Young day in press). The professional skills base, training and work undertaken vary across Europe, some examples of these differences will be used to explore this exciting and evolving profession.

SS05-03

Educational Audiology in a school for special education

Muller C.

Centre de Logopédie, Val St.-André, Luxembourg

The Educational Audiology (EA) of the Centre de Logopédie (CL) has been installed in 2007. The CL is the only specialised school for deaf, hard-of-hearing and speech/language impaired children in Luxembourg. The EA is traced back to a cooperation starting 2004 between the CL and the University of Cologne in Germany, where most of the Luxembourgish "Professeurs d'enseignement logopédique" (special teachers) have been studying. In the context of this cooperation, Frans Coninx of the University of Cologne initiated the installation of an EA-unit and provided a teacher training course in EA for a small group of teachers of CL.

The EA of the CL is active in two different areas:

- the diagnostic group, which every child that is refered to CL for a diagnosis and before being admitted to CL has to pass through,
- the long-term monitoring of deaf, hard-of-hearing and speech/language impaired children.

This presentation focuses on the aspects of support and monitoring of the developing hearing skills in deaf and hard-of-hearing children/pupils. This means concretely to control regularly the hearing levels in a familiar environment, to propose the best solutions and to coordinate the support if problems are observed and reported by the teachers, to advice and support teaching staff in questions to enhance listening skills and to advocate optimization of the acoustic environment.

This means that the EA unit in CL appears as the central point of the different stakeholders involved in the hearing process of the child: the child itself, the school environment, the parents, the medical doctors (ENT), the hospitals, the CI-centres, the acoustician, the health ministry and the hearing aid providers. The aim of this work always consists in making hearing aids or simply hearing work in daily live. Concrete examples will be presented in order to illustrate the EA work.

SS05-04

Educational Audiology, methodology for APD

Baas E.

Royal Dutch Kentalis

Auditory Processing Disorders (APD) are difficult to define and diagnose, due to correlations and co-morbidities with other disorders. Children with APD need and deserve an adequate diagnosis, since that will open ways for effective remediation.

In this presentation the definition APD and its correlations will be presented and discussed. Based on that the screening and

diagnosis of APD will be presented, with an attempt to unravel the muddle of co-morbidity.
The major need of educational practice, after a diagnosed APD, is how to translate this diagnosis into effective remediation.
Evidence-based methods for diagnosis and treatment of APD will be summarized and discussed. Remediation is often categorized in direct training, compensation strategies and adjustment of the environment. This categorization will be discussed and reported effects of remediation for APD will be reviewed: what is the effect in practice on educational performance of children with APD?

SS05-05

Educational audiology in school screening

Piotrowska A.

Institute of Physiology and Pathology of Hearing, Warsaw/Kajetany, Poland

There is a solid evidence that untreated hearing loss ≥35 dB HL can have a negative impact on speech, language, and cognitive development, and subsequently on academic achievements. Moreover, several studies reported that children with mild hearing losses which often appear to function normally in everyday situations, they also are at considerable risk for academic and behavioral problems (Crandell 1993, Hall et al 2000, Bess 1998, Tharpe 2009).
Therefore, it is relevant to assess the hearing status and it's impact on educational problems of 7-year-old children. This presentation reports on a project in Poland.
Material and Methods: Hearing pure tone threshold screening (.5, 1, 2, 4, 8 kHz) was performed in the group of N=95410 children. First-grade students from primary schools in the villages and small towns in western Poland were included into the Program. Testing was performed within the last two months of the school year. School achievements were assessed with the use of the questionnaire administered to parents and teachers. The positive result of screening was defined as air conduction thresholds equal or more than the minimal hearing loss (MHL). MHL was defined as: unilateral sensorineural hearing loss (snhl), with average AC threshold (.5, 1, 2 kHz) of more than 20 dB in impaired ear; bilateral snhl, with average air AC thresholds between 20 and 40 dB (1, 2, 4 kHz) or high-frequency snhl, with AC thresholds greater than 25 dB at two or more frequencies above 2 kHz in one or both ears.
Results: Positive results of pure tone threshold screening were obtained in almost 6% of tested children. Majority of this group constitutes individuals with minimal hearing loss. In the group educational problems were observed twice more frequently than in children with normal hearing as reported by parents.
Conclusions: The results indicate the substantial prevalence of the hearing problems and its negative consequences in school-aged children. Raising awareness and maintaining school oriented efficient approaches towards children with hearing problems should be the goal of educational audiology.

SS05-06

Educational Audiology for "difficult to test" children

Wiesner T.

Department of Phoniatrics and Pediatric Audiology, Werner Otto Institut, Hamburg, Germany

Every child is unique and has different needs demanding different approaches but this is even more true with multihandicapped children. Many of these children and their families have already encountered a number of traumatizing experiences before the child's hearing is tested. In case of the diagnosis of a permanent hearing loss another significant burden is added to an already struggling family. Under these circumstances the hearing loss is just one in a row of medical, developmental and social problems. Together with the parents one has to find their individual way when and to what extend to deal with the hearing problem. But besides the often demanding counselling these children also challenge the professionals in the diagnostic and therapeutic process. To achieve more reliable test results one may need special techniques like using vibratory and tactile reinforcers ("Air-Puff"-audiometry or the "Touch-Trainer") or the TROCA procedure. Concerning the fitting of hearing aids one may consider that often multihandicapped children are treated differently by their environment: They rely more on a one to one interaction and they can get acoustically "overloaded" more easily. So amplification should be supplied even more cautiously. Mostly the first step will be to establish a reliable but not overloading auditory input. To facilitate the communication skills most of these children will need a multi sensory approach including hearing, oral speech and visual signs.
The main emphasis of the presentation will be the necessary adaptations in the hearing assessment protocol of multiply handicapped children, emphasizing also the need of a closely cooperating multidisciplinary team to meet the complex needs of these children and their families.

SS06

European Consensus on Hearing Screening in School-age Children

Moderators: Henryk Skarzynski, Kurt Stephan, Anna Piotrowska

Speakers:
1. H. Skarzynski
2. A. Davis
3. A. Piotrowska
4. K. Stephan

Summary
This is a joint initiative at the invitation of Prof. Henryk Skarzynski, director of the Institute of Physiology and Pathology of Hearing in Warsaw, to produce a consensus statements on Hearing Screening in School-age Children, as well as on Hearing, Vision and Speech Screening in School-age Children, by European specialists in various fields including audiologists and phoniatricians, otolaryngologists, ophthalmologists, psychologists, educators and speech therapists.
The appropriate development of sense organs like hearing and vision with adequate speech – are the foundation for communication in modern society. At the same time, dysfunctions within these structures are reported to be one of the most common health problems. Furthermore, the early onset problems unfavourable influence the proper development and the future of children who suffer from communication disorders. Hearing, vision and speech disorders in children constitute significant reason for the delay in the child development, difficulties in acquisition of language skills, as well as in effective communication at school and in everyday life. Communication disorders in childhood, when untreated, may result in further negative consequences, such as decreased educational achievements, reduced employment opportunities and problems with social adaptation. The crucial role of prevention and monitoring is incontrovertible. Universal hearing, vision and speech screening in school-age children is an effective tool for early-diagnostics and the detection of communication disorders, enabling to undertake a proper, early treatment and create equal educational opportunities for all children.
The topic of "Equal educational opportunities for children with communication disorders" is an integral part of the health Priority "Closing the Gap in Health in Europe" approved for the Polish Presidency of the EU Council, and is led by the Institute of Physiology and Pathology of Hearing in the cooperation with the Department of Mother and Child of the Ministry of Health.

SS07

Patients with long experience with CI

Moderators: Gerard O'Donoghue, Artur Lorens, Piotr Henryk Skarzynski

SS08

Title Politzer Society

Moderator: Nuri Ozgirgin

Speakers:
1. **Nuri Ozgirgin** • The treatment policies of middle ear pathologies in regard to hearing, indications, expectations and long term results
2. **Angel Ramos** • Early Hearing Detection. New politics in Cochlear Implantation in children
3. **Hans-Peter Zenner** • Cell biological basis of sensory neurohearing loss
4. **Roberto Filipo** • Intratympanic injection in the treatment of sudden seafness
5. **Alec Fitzgerald O'Connor** • Middle Ear Implants theory and practice

SS08-01

The treatment policies of middle ear pathologies in regard to hearing, indications, expectations and long term results

Ozgirgin N.

Bayindir Hospital Sogutozu, Otolaryngology Department Ankara Turkey

Middle ear ventilation, intact tympanic membrane and functional ossicular chain are the essential factors for normal conductive hearing. In case of any stress factor limiting the function of the above mentioned factors hearing will be impaired. The perforation of the drum will diminish hearing due to its size and location. The fixation and/or disruption of the ossicular chain is the main concern when the hearing thresholds remain in 60 dBs. However in case of having an accompanying factor such as cholesteatoma the hearing levels may simulate the normal conditions in the middle ear.
Precise otomicroscopic, otoendoscopic examination coupled with high resolution computed tomography and audiologic evaluation can predominantly give idea to predict the functional outcome of the surgery. However the surgical technique applied for reconstruction the ossicular chain and the tympanic membrane, the grafts and the prostheses used for this purpose will be the affecting factors for the audiologic outcome. In this lecture the surgical techniques will be discussed in regard to the audiological output.

SS08-03

Cell biological basis of sensory neurohearing loss

Zenner H.-P.

The University of Tübingen, Germany

Sensory neural hearing loss may be subdevided in four types. Type I may be called the motor type. It is due to a functional loss of outer hair cell function.
Type II is associated with the transduction process and may be called transduction type.
Type III hearing losses are due to a problem of the transformation process between inner hair cells and afferent nerve fibres.
Type IV are sensory hearing losses due to pathophysiological processes of the nonsensory tissue of the inner ear.

SS08-04

Intratympanic Injection in the Treatment of Sudden Deafness

Filipo R.

Department of Sensory Organs, University "Sapienza", Rome ITALY

Sudden sensorineural deafness can be defined as a hearing loss greater or equal to 30 dBHL involving 3 adjacent frequencies, developing within 72 hours. To date, in the majority of cases, sudden idiopathic deafness has been treated traditionally with oral administration of steroids either alone or in association with other substances. The Authors present their experience in about 100 patients using an alternative method, analizing the effectiveness of Intratympanic administration of high doses of steroids to be carried out once a day for 3 following days. Results were analized and compared with those obtained in traditional protocols, basing findings on profiles for pure tone audiometry and degrees of hearing loss.

SS08-05

Middle Ear Implants theory and practice

Fitzgerald O'Connor A.

Hunterian Professor Royal College of Surgeons, Auditory Implant Department, St Thomas' Hospital, London, UK

The concept of Vibratory Stimulation of the auditory system rather than Acoustical (Normal / Acoustic Hearing Aids) or Electrical (Cochlear Implants) will be discussed. The micromovement

of the ossicular chain will be reviewed in the light of Laser Doppler Vibrometry. The commercially available Middle Ear Implants will be described and their relative indications discussed. Surgical techniques will be illustrated with a review of personal data. Personal outcomes and those in the general literature will be reported.

Conductive hearing loss in Balkan Region Countries

Moderator: Milan Stankovic

Speakers:
1. Ibrahim Hizalan • Surgery of otosclerosis and tympanosclerosis
2. Cem Uzun • Cartilage tympanoplasty
3. Pavel Dimov • Conductive hearing loss after chronic suppurative otitis media surgery
4. Viktor Vital • Ossiculoplasty techniques
5. Milan Stankovic • Surgery for cholesteatoma: Follow up of influential factors

SS09-01

Surgery of otosclerosis and tympanosclerosis

Hizalan I.

Uludag University Medical School, Department of Otorhinolaryngology

Stapes surgery, in our hands, is always done under general anesthesia and via transcanal approach. A hole of 0.8 mm diameter is opened at the footplate and a teflon piston of 0.6 mm is inserted. The results (under statistichal analysis) will be presented at the panel.
Regarding tympanosclerosis, 1024 cases are operated during 13 years. The median age is between 31–40, bilaterality is seen in 32% of patients. 94% of the cases were "open tympanosclerosis". At the tympanic membrane level, localization of plaques (n=84) was dominant at the postero-inferior and antero-inferior qudrants. In the tympanic cavity, plaques were localised mostly at the mesotympanum, and mainly around the malleus and incus. Greft intake rate was %70. Major mean air-bone gap (32.1±7.8 dB) seen in patients with myringo-tympanosclerosis (n=44) was reduced to 19.6±8.1 dB after surgery.
The results of the surgery of otosclerosis is more successful than the surgery of tympanosclerosis.

SS09-02

Cartilage tympanoplasty

Uzun C.

Trakya University School of Medicine, Edirne, Turkey

Severe chronic otitis media with or without cholesteatoma is a common disease in the Balkan Peninsula. Fascia may not be a good graft material under such severe conditions. Cartilage is a common graft in tympanoplasty with high graft intake rates under such conditions compared to the fascia. However, due to its mass and rigidity, acoustic transfer is less with block cartilage grafts. However, several techniques have been developed to decrease the mass and the rigidity of the cartilage and consequently to increase the acoustic transfer. In addition, cartilage softens in the long-term and the compliance increases. The present author will give audiologic evidences on this subject and will describe three different techniques of cartilage tympanoplasty, which may have several advantages over the other techniques.

SS09-03

Conductive hearing loss after chronic suppurative otitis media surgery

Dimov P.

Professor and Head ORL Clinic, University Hospital, Trakia University Stara Zagora, Bulgaria

Material: A study over the chronic suppurative otitis media (COMs) is done. 10 years gathered material from diagnostics and operative treatment accomplished at over 186 patients with COMs (77-epitympanitis and 109-mesotympanitis) is used.
The methods: of diagnostics used are medical history, status, audiometry, tympanometry, image diagnostics (X-ray examination, computer tomography CT, magnetic resonance MRI) and endoscope examination is introduced.
Results: COMs treatment – over 77 (41.4%) patients open, closed and combined (49.35%) operative techniques are performed. Very good final results of patients' recovery are obtained – 87.17% at the former and 86.84% at the second ones. The general average value of ABG pre/post operation is 27.09 dB/17.42 dB at the curing operations. 70.09% of the cases show ABG ≤20 dB. At 109 (58.6%) patients reconstructive techniques (tympanoplasty type I, II, III) are performed. The general average value

of ABG pre/post operation is 25.54 dB/13.15 dB in the plastics done. 95% of the cases show ABG ≤20 dB.
COMs Training: Internet page *www.prootology.domino.bg* in ENT specialty and 19 scientific meetings (11 in the direction of otology and 8 in the direction of diseases with social significance) are held; the 4 cadaver dissections in the otosurgeons training are organized
Conclusions: The results received are comparable with those of leading otosurgeons at home and in the European Union (EU). A training and qualification is pursued throughout contemporary forms and instruments of education, compatible with the rules and requirements of EU.
Key words: chronic suppurative otitis media, conductive hearing loss, cholesteatoma

SS09-05

Surgery for cholesteatoma: Follow up of influential factors

Stankovic M.

University ORL Clinic Nis, Serbia

Patients: Retrospective study of patients operated for acquired middle ear cholesteatoma during the period 1990-2002 was performed. Total 758 patients were followed during short-term and 611 patients during long-term period. The patients were divided into three age groups: children, adolescents, and adults. The localization of cholesteatoma was classified as: attic, sinus, or tensa. Closed tympanoplasty was always performed as single procedure of choice on all the children, and reoperation or conversion to open tympanoplasty was made later if needed. Adult patients were treated with single classical canal wall up, or wall down, according to the propagation of disease and condition of middle ear. Preoperative and postoperative air bone gap (ABG), and pure tone average (PTA) were compared after short term and long term follow up.
Results: Both preoperative and postoperative hearing level was worse for children, than adolescents, or adults. Revision operations and bilateral cholesteatoma gave worse total postoperative hearing. The long-term results of primary operations, when recurrent cholesteatoma did not occur, were stable. Damage of auditory ossicles correlated well with total preoperative and postoperative results. The most of hearing improvement was verified for the frequencies between 500 and 3000 Hz, and there was no sensorineural hearing loss.
Conclusions: The audiological results of cholesteatoma surgery are preserved during long-term follow up. We found that recurrent cholesteatoma was associated with diminished postoperative hearing. Poorer preoperative hearing level, CWD tympanoplasty, younger age, bilateral cholesteatoma, and ossicular damage, as well as revision surgery, were associated with reduced gains in hearing with surgical management. The learning curve in surgical treatment of cholesteatoma was also significant.
Key words: tympanoplasty, cholesteatoma, attic, sinus, tensa, age, air bone gap, pure tone average.

SS10

Sensorineural hearing loss in Balkan Region Countries

Moderator: Milan Stankovic

Speakers:
1. Nenad Arsovic • Surgical approaches for CI
2. Stan Cotulbea • Cochlear Implant in ENT Department Timisoara
3. Borislav Gogusevski • Surgical techniques in cochlear implantation
4. Sanja Spiric • Cochlear implantation program in Bosnia and Herzegovina

SS10-02

Cochlear Implant in ENT Department Timisoara

Cotulbea S.

ENT Department "Victor Babes" University of Medicine and Pharmacy Timisoara

Objective: To present our 8 years experience in cochlear implantation. Hearing loss, especially in children, is one of the most challenging pathologies in otolaryngology. Screening, evaluation, early diagnosis, surgical treatment, and rehabilitation of children with profound sensorineural hearing loss raises different problems from those encountered with adults. Our continuing concern has been to offer the best chances to children with hearing impairment by improving early diagnosis and lowering the age of implantation.
Study Design: In the ENT Department of the University of Medicine Timisoara, 79 patients received cochlear implants between January 2003 and December 2010. Most procedures were performed in patients with prelingual hearing loss (mean age, 3,1 years). Patients were evaluated audiologically (pure-tone thresholds, vocal audiometry, electrocochleography, brainstem auditory evoked response, assessment of benefit offered by hearing aid), psychologically and through medical examination, computed tomography scans of the temporal bone. The proportion of profoundly deaf children implanted at or before age of 3 has increased considerably. The age at witch children with severe

to profound HL can be implanted has been significantly lowered based on the premise that the earlier auditory input is provided, the

Results: Postoperative rehabilitation started 1 month after surgery, with additional evaluations at 3, 6, 9, 12, 18, and 24 months postoperatively and then every year. 79 cochlear implants have been performed – 78% children under the age of 6. Postlingual deafness – 5 cases and prelingual deafness – 74 cases. 74 MedEl devices (28 COMBI 40+, 38 PULSAR CI 100 and 8 SONATA TI 100), 2 Cochlear – Nucleus 24 K, Nucleus 5 devices and 3 Advanced Bionics – Hi-Res 90k devices. The evaluation methods were directed toward psychologic and logopedic criteria. It is now widely recognized that age at implantation is an important factor in the successful development of spoken language, early cochlear implantation is associated with improved speech perception and production outcomes. Central auditory plasticity and the existence of a sensitive or "critical" period in the maturation of the central auditory system have been well demonstrated. Cochlear implantation should occur not only early enough for normal language development to be achieved but also before the child has begun to lag behind his age group. Poor language skills and/or limited parent-child communication interactions early in life are associated with socio-emotional and behavioral problems.

Conclusions: The cochlear implant has radically changed the outlook for profoundly deaf adults and children. It is not possible to predict the benefit an individual will obtain from a cochlear implant, but we can conclude that children born deaf will have greatest benefit if they would be implanted before the age of 5, and preferably by the age of 3, and the longer the period of profound deafness, the more limited the benefits. It is of utmost importance that profoundly deaf children with cochlear implants be entered into a rehabilitation program.

SS10-03

Surgical techniques in cochlear implantation

Gogusevski B.

University ENT Clinic, Skopje, Rep. of Macedonia

Cochlear implantation is widely accepted ENT procedure. 2007 reports for more than 120 000 cochlear implantations worldwide. Some optimistic reports from 2010 refer about the number of 180 000 implantations.

Candidate selection according to the standard criteria and precise CT evaluation are important prior to decision of the side of implantation – worse or better hearing ear?

Cochlear implantation can be done by qualified surgeon well trained for performing this surgical procedure.

Surgical history of cochlear implantation points few techniques:

- transmeatal technique – main disadvantage is unsecured electrode array easily exposed to mechanical or infectious damage,
- suprameatal technique – long way of electrode placement, possible damage,
- mastoidectomy – tympanotomy posterior technique – widely accepted, safe for the electrode array. Soft surgery technique with best postoperative results,
- robotic guided implantation – is this the future of cochlear implantation?

SS10-04

Cochlear implantation program in Bosnia and Herzegovina

Spiric S.

KC Banja Luka, ENT Clinic, 12 beba bb, 78000 Banja Luka, Bosnia and Herzegovina

Background: In Bosnia and Herzegovina cochlear implantation program is conducted in three centers. The program started 9 years ago. ENT clinic Banja Luka is one of these centers fully qualified for the complete preoperative diagnosis, surgical treatment and postoperative rehabilitation.

Aim: Aim of this study is to determine degree of socialization and communication abilities in children implanted up to 5 years of age in our environment.

Material and Methods: In this paper we analyzed the resuslts of 32 patients included in the cochlear implantation program at the following criteria:

1. Children aged 1–5 years with no other malformations of importance for the outcome of cochlear implantation.
2. Profound bilateral sensorineural hearing loss
3. Conducted post-operative rehabilitation for a period of three years(individual and group work)

Results: In whole group there were 13 patients aged from 1 to 3 years an 19 aged from 3 to 5 years at the time of implantation. In the postoperative period we followed results of speech discrimination and recognition tests. In the first phase of test we used "closed set" and then "open set" adjusted age. The first group of subjects(1-3 years) achieved a score of 83% and the second (3–5 years of age) "open set" three years after surgery.

Conclusions: Test results show that children under the age of 5 at the time of implantation can achieve approximately the same results in social contact within 3 years after surgery with good selection criteria. Despite good test score, age at time of implantation limits the possibilities for socialization and intellectual development.

SS11

The new era of Adult Hearing Care: Challenging screening and intervention for hearing disability in adults and older adults

Moderator: Ferdinando Grandori

Speakers:
1. **Ferdinando Grandori** • Adult hearing screening and the European Project Ahead II
2. **Adrian Davis** • Screening for hearing problems in the adult population
3. **Gabriella Tognola** • Screening for hearing disability and communication disorders in adults: what should we focus on?
4. **Sophia E. Kramer** • Strategies following screening for hearing disability in adults

SS11-01

Adult hearing screening and The European Project Ahead III

Grandori F.

Institute of Biomedical Engineering – CNR, Milan, Italy

Increasing evidence indicates that screening and early treatment of hearing disability have the potential to significantly improve the quality of life and extend the functional status of adult population. Hearing disability is indeed one of the most common chronic health conditions in older adults, and have important implications for the quality of life, such as functional decline, depression and social isolation. According to the report released in 2008 by the World Health Organization on the global burden of diseases, hearing loss is the first among the 20 leading causes of moderate-to-severe disability. Age-related sensorineural hearing loss is the most common type, with a prevalence of up to about 40% in older adults. As such, because of the ageing population, the number of people suffering from hearing loss will increase even more in the near future. As the populations in the Western world are likely to be obliged to retire at an older age, good hearing function will also be required for a longer period in the senior working population. It is easy to predict that hearing in noise and other difficult listening situations at work will become more relevant to this age group. In most cases, hearing loss in adults takes a long time to develop. It is a progressive process, and does typically produce a slow habituation to the impairment. This is probably the most underestimated aspect of all the previous ways of approaching early hearing identification. Screening programs can be advocated if i) effective intervention strategies and criteria must be available for the detected condition, and iii) accurate, practical and convenient screening tests exist. This Session is being held as part of the AHEAD III project. (Assessment of Hearing in the Elderly: Aging and Degeneration - Integration through Immediate Intervention (2008-2011).) AHEAD III is a project funded by the European Commission, FP7 – Health, Chronic Diseases: Hearing Impairment and Degeneration. Project AHEAD III involves a network of laboratories and clinics from across Europe with complementary capacities and expertise. It was designed to:

- Provide evidence of the effects of hearing impairment in adults and particularly in the elderly;
- Increase the awareness among administrators, policy makers, health care professionals and the public opinion about early detection and intervention for hearing impairment in adults and particularly in the elderly;
- Analyze costs associated with the implementation of integrated large scale, or nationwide, programs of hearing screening and intervention in the aged population;
- Provide minimum requirements for screening methods and the related diagnostic techniques;
- Develop recommendations and guidelines on how to implement successful screening programs and began setting new criteria for recently proposed new technologies;
- Analyze protocols and models to be tuned to the local, social, and economical conditions of a country or region.
- Evaluate strategies of interventions and identify links between screening/diagnosis and intervention strategies to build an integrated model of care.
- Find ways of optimizing bridges between Early Hearing Detection and Intervention programs (EHDI) and the global health strategy.

SS11-02

Screening for hearing problems in the adult population

Davis A.

MRC Hearing & Communication, 344-354 Gray's Inn Road, London, UK

In Europe, there are 26% of adults with a bilateral hearing problem that impairs their ability to hear in noisy situations substantially and a further 2% who have substantial unilateral hearing problems, impacting substantially on their ability to locate a sound (e.g. car, bus, voice). The prevalence is highly related to age. There is no remission. There is a similar prevalence worldwide on an age adjusted basis. Of the 26% in the UK, only 3–4% have consulted a doctor about their hearing problem and currently receive support from the NHS. About half,13%, have really substantial hearing problems (with substantial co-morbidity in tinnitus and balance problems) and would receive huge benefits from amplification if provided and accepted (around £1–2k per QALY gained, Davis et al 2007). There are several ways in which support for hearing problems could become more accessible, more acceptable and more effective. Hearing aids and aids to hearing are not the only answer, but they are a key part of the solution. Systematic screening in Europe, European countries and towns could be very cost effective and reduce the impact of

hearing problems such as early mortality, depression and loss of independence. The AHEAD project systematically reviewed the ways in which health systems can translate screening and triage concepts into services that provide more effective and value added support for individuals. Piloting this translation has generated good practice in using screening equipment and systems.

SS11-03

Screening for hearing disability and communication disorders in adults: What should we focus on?

Tognola G.

CNR-National Research Council of Italy, Institute of Biomedical Engineering

Age-related hearing loss is a relevant and increasingly spread psychosocial problem, with significant implications in terms of quality of life, distress, loneliness, or depression. Yet, despite their prevalence and burden, hearing loss and hearing disabilities in adults and older adults are largely underdetected and undertreated, in the lack of accepted guidelines, protocols and legislation. Hearing ability is a combination of peripheral and cognitive auditory processing and requires, concurrently, the ability to hear, to listen, to comprehend, and to communicate. The World Health Organization's International Classification of Functioning, Disability and Health, describes auditory dysfunction using three different definitions: i) hearing impairment, i.e. the loss of hearing sensitivity; ii) hearing handicap, i.e. the experienced difficulty to listen and to comprehend spoken messages in noisy environments, typically resulting in activity limitations; and iii) hearing disability, i.e. the inability to communicate with people or a restriction in social participation. Some individuals with hearing impairment may not perceive any hearing disability and, vice versa, others with minimal or no hearing impairment may report considerable disability.

It follows that, depending on the methodologies and techniques that are used to screen adults, different domains of auditory dysfunction can, in principle, be identified: either hearing impairment, or hearing handicap, or hearing disability.

This presentation will review the technologies for adult hearing screening mostly used and for each of them it will be discussed what are the specific domains of auditory dysfunction they adressed.

SS11-04

Strategies following screening for hearing disability in adults

Kramer S.E.[1], Pronk M.[1], Stephens D.[2], Smith P.[3], Davis A.[4], Parazzini M.[5], Thodi C.[6], Anteunis L.J.C.[7], Grandori F.[5]

[1] *VU University Medical Center, Amsterdam*
[2] *Cardiff University, Cardiff*
[3] *Royal Free Hampstead NHS Trust*
[4] *Royal Free Hampstead NHS Trust, London,UK*
[5] *Institute of Biomedical Engineering, Milan*
[6] *CH & M Cyprus Audiology Center Interacoustics Ltd, Cyprus*
[7] *Maastricht University Medical Centre, Maastricht*

Objective: One of the workpackages within AHEAD III focuses on interventions following screening for hearing disability in the adult or elderly population. The primary aim is to review and discuss published data on the availability and effectiveness of interventions following screening. Adult hearing screening may be a solution to the under-diagnosis and under-treatment of hearing loss in adults. Limited use and satisfaction with hearing aids indicate that consideration of alternative interventions following hearing screening may be needed. This presentation provides a systematic descriptive review of intervention types that have been offered to adult (18 y) screen-failures so far.

Methods: Systematic descriptive literature review. Articles were identified through systematical searches in PubMed, EMBASE, Cinahl, the Cochrane Library, private libraries and through reference checking. Relevant screening programme characteristics were extracted by two independent researchers.

Results: Of the initial 3027 papers obtained from the searches, a total of 37 were found to be eligible. Most of the screening programmes (i.e., 26) referred screen-failures to a hearing specialist. Seven of the remaining studies offered hearing aid fitting. Four studies offered alternative interventions covering communication programme elements (e.g., speechreading, hearing tactics) or advice on environmental aids.

Discussion and Conclusions: Interventions following hearing screening published so far generally comprised referrals to hearing specialists or directly offered hearing aid rehabilitation. Some programmes offered alternative rehabilitation options. Non-hearing aid interventions should be considered for those not wishing to have hearing aids. Controlled studies on the effectiveness of non-hearing aid interventions following screening for hearing are highly required.

SS12

Hearing aid fitting in infants

Moderator: Einar Laukli

Speakers:
1. **Einar Laukli** • Hearing aid fitting in infants
2. **Adrian Davis** • Hearing aid fitting in infants – quality and outcomes
3. **Jolanta Serafin-Jozwiak** • Assessment of hearing impairment in infants
4. **Kristin Kerkhofs** • Hearing aid fitting under the age of six months

SS12-01

Hearing aid fitting in infants

Laukli E.

Department of Otorhinolaryngology, University Hospital, Tromsø, Norway

Today's infant hearing screening programs have led to early detection of hearing loss, and a threshold may be determined by an age of 3-4 months or even earlier. Early intervention is crucial, and according to common consensus, the fitting of hearing aids shall be performed around 6 months of age, or at least started at that age. Several problems arise around this activity. What audiometric data can be used as a basis for hearing aid fitting? Normally ABR or ASSR will give the threshold data to be used in the fitting rationales. Do these methods give the necessary sensitivity and frequency specificity? Another point is the infant ear, where both the external ear and middle ear deviates from the adult peripheral system. Calibration data are based on adult ears. The infants' hearing thresholds are also considered to be higher than in the adults. Some of these aspects will be discussed in the papers presented in this special session.

SS12-02

Hearing aid fitting in infants – quality and outcomes

Davis A.

Director NHS Newborn Hearing Screening Programme, MRC Hearing & Communication, 344-354 Gray's Inn Road, London, UK

The advent of newborn hearing screening gives a great opportunity to improve outcomes for deaf children and their families. The quality of screening programmes may vary, but on the whole systematic screening programmes have standards and audit to those standards. The services for children identified by newborn hearing screening, who are identified after a subsequent trauma or who develop a hearing loss, are not as well specified nor are they usually well audited. Obviously the services for deaf children and their families are more complex than a screening programme. In England, we have worked on the standards for paediatric audiology that we would want people to work to and are beginning a system of accreditation of those services by professional bodies. An outline specification and accreditation system for paediatric audiology will be presented alongside case studies that clearly show the need for close multi-discipinary cooperation in order to meet children's needs.

SS12-03

Assessment of hearing impairment in infants

Serafin-Jozwiak J., Piotrowska A., Ratuszniak A., Olszewski L., Obrycka A., Lorens A., Skarzynski H.

Institute of Physiology and Pathology of Hearing, Warsaw/Kajetany, Poland

Background: Over the past 20 years, spectacular developments have occurred in the field of pediatric audiology in Poland. The first programs of newborn screening were launched in 1993 by Institute of Physiology and Pathology of Hearing. The universal newborn screening screens now approximately 98% of newborns in Poland.
Aim: to present assessment and interventions procedures in infants with hearing impairment
Method: Assessment of hearing impairment is based on objective and behavioral methods as well as parental questionnaires. Polish version of the LittlEARS® Auditory Questionnaire (LE-Q) is administered to assess child's auditory development. Children with severe to profound hearing loss and children with partial deafness are considered for cochlear implantation.
Conclusions: By detecting hearing loss as early as possible effective treatment can be applied. However, infants with partial deafness are at risk to be diagnosed incorrectly.

SS12-04

Hearing aid fitting under the age of six months

Kerkhofs K.

Audiologist, Rehabilitation Centre De Poolster, Brussels, Belgium, Lecturer, Artevelde University College, Ghent, Belgium

More than thirteen years ago a programme of universal newborn hearing screening has been introduced in the northern part of Belgium (Flanders) by the Gouvernemental Health Service 'Kind & Gezin' (Child and Family). Since then a lot of hearing impaired babies have been fitted with hearing aids at a very young age, mostly before the age of 2 - 3 months. During these years we have seen a great evolution in the way the hearing manufacturers cope this issue. At this moment a lot of tools, special fitting rationales, hearing aids, measurements are available. But how do we have to handle all this?
In my presentation I will talk about the fitting procedure of hearing impaired babies, used in most of the rehabilitation centres in Flanders. This procedure starts with a cross check of the audiometric test results. Besides objective test results obtained from ABR and ASSR we try as much as possible to complete our data with behavioural audiometry. Further I will talk about the selection of the hearing aid type, technical features, measurements and how to evaluate them.

Binaural hearing aid signal processing (basic requirements, algorithms, results)

SS13

Moderator: Norbert Dillier

Speakers:
1. Ian Wiggins • Psychophysics of binaural hearing – Effects of inconsistent binaural cues
2. Steven Schimmel • Binaural models and virtual acoustics to study spatial perception
3. Volker Hohmann • Signal processing for noisy and reverberant environments
4. Wouters J. • Evaluation of hearing aid signal processing algorithms

SS13-01

Psychophysics of binaural hearing – Effects of inconsistent binaural cues

Wiggins I., Seeber B.

MRC Institute of Hearing Research

There are well established benefits of having two ears for understanding speech in noise, locating sound sources, and functioning in reverberant rooms. These benefits are obtained by exploiting differences in the sound arriving at each ear – interaural time differences (ITDs) and interaural level differences (ILDs). Thus people with hearing loss in both ears might benefit substantially from the use of two hearing aids. However, this requires that the hearing aids present useful and reliable binaural information. Dynamic-range compression is a type of signal processing routinely used in modern devices. When compression acts independently at each ear, ILDs are altered from their natural values, introducing inconsistency between ITDs and ILDs. We have investigated the perceptual consequences of this type of processing in normal-hearing listeners using virtual acoustic stimuli. A first experiment studied the impact on the spatial attributes of sounds using a questionnaire method, and a second experiment looked for corresponding effects in judgements of lateral position. Compression generally shifted sounds towards a more central position, consistent with a reduction in ILDs. For sounds containing gradual onsets and offsets, including speech, compression generated dynamic ILD changes at rates low enough to be followed perceptually. In such cases, the perceptual effects were more severe: listeners often reported moving and/or split images, and the separation between the reported leftmost and rightmost extents of the sound increased substantially. Compression also resulted in slightly poorer externalization of sounds. The severity of the effects was greatest for high-pass sounds, and was reduced when undisturbed low-frequency binaural cues were made available. The studies identified specific conditions in which unsynchronised bilateral compression severely affects spatial perception, and thus found situations in which both ITDs and ILDs should be preserved.

SS13-02

Binaural models and virtual acoustics to study spatial perception

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Binaural hearing aids on the market today have a low-bandwidth binaural link that enables the synchronization of program settings. And in the near future, binaural hearing aids with a

full-bandwidth binaural link will be commercially available. The full link will make current hearing aid algorithms (e.g., beamformer, noise reduction) more powerful, because they can exploit the extra microphone signals at larger spatial separation. It will also allow new algorithms, such as better-ear-listening or binaural feedback suppression.
The ultimate goal of binaural hearing aid processing is to preserve the binaural cues of the acoustic scene, in order to achieve accurate externalization and localization of sound sources. This would result in a more natural listening experience for the hearing aid user, reducing
listener fatigue and improving spatial release from masking.
To develop binaural signal processing algorithms that preserve the acoustic scene, it is important to understand the effects of binaural cues on spatial perception. To this end, we have developed a virtual acoustics simulator (roomsim) and a simulator of the signal processing in the binaural
auditory system (bassim). In this talk, we provide a brief overview of both simulators, and show how they can be applied to study spatial perception.

SS13-03

Signal processing for noisy and reverberant environments

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Difficulty in communication in noisy and reverberant environments is the most common complaint of people with hearing impairment. To alleviate this problem, modern digital hearing aids use different types of noise reduction techniques such as single-channel noise reduction and adaptive directional microphones. Subjective and objective evaluations of these processing schemes in a range of realistic listening conditions involving noise and reverberation show improved listening comfort and, in the case of directional microphones, a benefit in speech intelligibility. Latest technology allows linking the hearing aids at both ears using a wireless transmission link, which extends the processing options towards binaural (two-ear) processing. Several schemes for advanced signal processing using multi-channel binaural input have been proposed, e.g., the multi-channel Wiener filter, multi-channel beamformers and reverberation filters. Objective and subjective laboratory evaluation shows that these schemes can potentially improve communication in difficult listening conditions further. However, even when using these advanced algorithms hearing impaired listeners do not reach the performance of normal hearing listeners in complex listening conditions. The major reason for this is that the normal-hearing auditory system uses very effective and robust methods of decoding information on sound sources from a superposition of sounds coined as 'Auditory Scene Analysis', which is far less effective in the impaired auditory system and which is not yet used extensively in signal processing schemes for hearing aids. Novel multidimensional statistical filtering algorithms have been introduced that might fill this gap in the future. These schemes incorporate a priori knowledge on the characteristics of the sound sources and thus can better estimate the contribution of each sound source to a superposition of sources than traditional techniques of noise reduction and speech enhancement.

SS13-04

Evaluation of hearing aid signal processing algorithms

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Background: Recently, the technical evolution of a wireless link in bilateral hearing instruments has allowed the exchange of information as well as audio-microphone signals (preprocessed or not) between the left and right device. However, at present the number of real binaural implementations showing improved benefit relative to bilateral is limited.
Aims: New signal processing strategies are developed to improve binaural hearing in bilateral hearing instruments, using 2 hearing aids or 1 hearing aid and 1 cochlear implant (bimodal). Examples of 2 developments will be given with an emphasis on objective and perceptual performance measures.
Methods: Different bilateral and binaural noise reduction processing schemes for 2x2 microphones (also speech distortion weighted multichannel Wiener filter, SDW-MWF) are evaluated. The algorithms are implemented on a real-time research platform to allow the assessment of realistic adaptive versions with normal and hearing impaired listeners.
Secondly, an algorithm that emphasizes fundamental frequency modulations is evaluated for perception of interaural time differences (ITD) in bimodal patiënts.
Results: The SDW-MWF algorithms are capable of significantly increasing speech intelligibility in several scenarios, with a real voice activity detector implemented. The modulation enhancement algorithm results in significantly lower ITDs in voiced stimuli.
Conclusions: The newly developed signal processing strategies demonstrate that binaural approaches can lead to benefit in binaural vs bilateral hearing.

Noise-induced hearing loss

Moderators: Mariola Sliwinska-Kowalska

Speakers:
1. **Paul Avan** • Significance of cochlear distortion in relation to noise-induced damage to outer hair cells
2. **Robert Dobie** • Myths Surrounding Noise-Induced Hearing Loss (NIHL)
3. **Mariola Śliwinska-Kowalska** • The use of personal music players and the risk of hearing loss in teenagers
4. **Adrian Davis** • Hearing Loss is a public health problem determined by noise and life-course events
5. **Paul van de Heyning** • Tinnitus in young adult college students after loud party music: An attitude paradox

SS14-01

Significance of cochlear distortion in relation to noise-induced damage to outer hair cells

Avan P., Giraudet F., Gilain L., Mom T.

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Cochlear outer hair cells (OHC) are highly vulnerable to noise-induced damage, and their loss of function results in detrimental perceptive consequences with concomitant losses in sensitivity and frequency selectivity, accompanied with a decrease in the ability of the cochlea to distort sound and emit otoacoustic emissions (OAEs). Accordingly, the detection of distortion product OAEs (DPOAEs) presents several advantages, that of being non-invasive, fast and frequency-specific, which allows a map of functional losses due to OHC damage to be plotted. This presentation will also present an overview of evidence that DPOAEs originate from OHC stereocilia bundles even though their propagation from the place where they have been generated to the outer ear canal involves several complex stages; that their behaviour when OHCs are damaged differs in several respects from the one corresponding to non functional OHCs yet with intact hair bundles –for example when the endocochlear potential is decreased-; that DPOAEs can sometimes detect subclinical damage. Their advantages and shortcomings will be compared to those of the more popular transient-evoked OAEs.

SS14-02

Myths surrounding Noise-Induced Hearing Loss (NIHL)

Dobie R.

University of Texas Health Science Center at San Antonio

Background: Everyone knows that noise causes hearing loss. Unfortunately, many common beliefs about NIHL are either untrue or unproven. Depending on the time allotted for this presentation, some or all of these myths will be discussed: A 4 kHz audiometric notch is proof of NIHL. People hear worse now than in "the good old days," because of increasing NIHL. NIHL is the #1 cause of hearing loss in North America and Europe. Recreational exposure to loud music is a major cause of NIHL. The risk and severity of NIHL is best predicted using a 3-dB exchange rate. Noise-induced threshold shifts continue even after the noise stops. Disability from NIHL should be assessed by high frequency audiometry (≥2 kHz) and/or speech audiometry. Population surveys of people without occupational noise exposure offer the ideal comparison standards for industrial noise-exposed populations.
Method: Literature review and analysis.
Results: Some of these beliefs are clearly incorrect, while some others may be true in limited contexts (e.g., #2 in developing countries, #6 in a specific strain of pre-adolescent mouse). For most of them, supportive evidence is either absent, insufficient, or outweighed by contrary evidence.
Conclusion: All of these beliefs are at best questionable.

SS14-03

The use of personal music players and the risk of hearing loss in teenagers

Sliwinska-Kowalska M.

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It has been shown that app. 17% of teenagers may have lost some of their hearing after leisure noise exposure and are not aware of it. Among the most common sources of noise exposure are noisy summer occupation, use of noisy equipment without hearing protection and loud music from personal music players (PMPs). According to the opinion of the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) delivered in 2008, a number of daily users of devices like PMPs are in dozen millions daily, and majority of them are adolescents. Assuming that the A-weighted, eight hour equivalent sound exposures levels from using PMPs on regular basis range between 75 to 85 dB(A), and mean weekly exposure time ranges from below 1 h to 14 hours, there is a minimal risk of hearing loss in majority of PMPs users. However, 5–10% of young listeners, which is equivalent to 2.5 to 5 mln of individuals, are at high risk of hearing loss after 5 or more years of exposure. The recent publications from large school based surveys confirm these trends. Accessible safety guidelines need to be developed for MP3 player use, particularly for college students who are likely to use them frequently, and in noisy environment. Long-term longitudinal cohort studies are needed to conclude whether the exposure to PMP music in teenage may influence hearing in older age.

SS14-04

Hearing Loss is a public health problem determined by noise and life-course events

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In Europe, there are 26% of adults with a bilateral hearing problem that impairs their ability to hear in noisy situations substantially and a further 2% who have substantial unilateral hearing problems, impacting substantially on their ability to locate a sound (e.g. car, bus, voice). The prevalence is highly related to age. There is no remission. There is a similar prevalence worldwide on an age adjusted basis. About a quarter of this may be attributable to noise. A small but substantial number of people acquire hearing loss as a complication of cancer treatment and there is no evidence that their hearing problems are diagnosed earlier. We can reduce the impact that noise and toxins have on the cochlea and on the auditory cortex, but age is still by far the biggest problem we have to tackle! In terms of noise, there are four main sources – background noise, social noise, environmental and occupational noise. How do we tackle all of these? Which are the most important messages for individuals, communities and governments? In addition to noise there is accumulating evidence that early social and biological factors may influence hearing in middle age. In addition there are factors such as alcohol, tobacco and diabetes that are also associated with high frequency hearing loss at this age. This offers the prospect that we should be combining public health effort with an effort to tackle environmental and personal factors affecting health and hearing health; this may be more effective than tackling the hearing conservation issues alone.

SS14-05

Tinnitus in young adult college students after loud party music: An attitude paradox

Gilles A., van de Heyning P., Kleine Punte A., de Bodt M.

University Department of Otorhinolaryngology and Head and Neck Surgery, Antwerp University Hospital, University of Antwerp, Antwerp, Belgium

Introduction: Listening to loud music, either at concerts or through personal listening devices (PLD's) has become a part of youth culture. As hearing complaints after loud music listening by young adults is frequently encountered, we hypothesized that many are unaware of the possible risks of frequent exposure to excessive noise levels.
Aim: To evaluate the prevalence of temporary and permanent tinnitus due to recreational noise, the use of PLD's and hearing protection among Flemish young adults.
Methods: A 19-question survey was designed to register the presence of tinnitus after parties or PLD use, the hours/week exposed to loud music, the attitude for loud music with the Yans questionnaire and the use of hearing protection. The questionnaire was presented to one-hundred 19 to 20 year old college students.
Results: 85% of the respondents report temporary tinnitus after parties or PLD use, of which 15% experiences a daily percept of tinnitus. Nevertheless, only 15% use hearing protection in loud music. 40% use nearly maximum volume settings of PLD's. In addition, 75% does not consider noise-induced hearing disorders including tinnitus as a problem and has no intention to lower the volume settings of PLD's nor to wear hearing protection.
Conclusions: The majority of young college students are insufficiently aware of the damaging impact of excessive loud music despite the fact that noise-induced tinnitus is very prevalent after a party among this population. This study learns that there should be more educational attention and preventive campaigns to increase the youth's awareness of the possible permanent effects of excessive loud music.
Acknowledgments: The study was supported by a grant of the Stavros Niarchos Foundation.

Auditory Effort: How to obtain a valid and reliable measure of listening effort?

Moderator: Sophia E. Kramer

Speakers:
1. Sophia E. Kramer • Auditory Effort How to obtain a valid and reliable measure of listening effort?
2. Mary Rudner • Understanding auditory effort by measuring cognitive spare capacity
3. Thomas Koelewijn • How the eyes betray what we hear: Pupillometry as an objective measure for listening effort
4. Jean-Pierre Gagné • The effort expended to recognize audiovisual speech in noise: A comparison of older and younger adults with normal hearing

SS15-01

Special session on auditory effort how to obtain a valid and reliable measure of listening effort?

Kramer S.E.

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When listening conditions are challenging because of interfering noise or a reduced quality of the auditory signal due to hearing impairment, speech comprehension becomes more effortful. People with hearing loss often complain about the constant effort to hear and concentrate and pay attention in order to communicate optimally. To compensate for their hearing loss, vigilance is required which often leads to fatigue.
Currently, there is a worldwide interest in the concept of listening effort and the possibility to quantify it. Several methods to assess mental effort (processing load) have been explored during the last decades. Recent developments within this research area will be presented during this special session. The key question is: how to obtain a valid and reliable measure of listening effort? During the first presentation, the issue of **cognitive spare capacity** as a measure to understand the potential mechanisms behind auditory effort will be addressed. The second paper will focus on the use of a **dual-task paradigm** to assess listening effort. An introduction to the method of **pupillometry** to quantify auditory processing load will be given in the third presentation. This paper as well as the fourth presentation will also highlight the results of some studies examining the magnitude of the pupillary response evoked by a number of tasks varying in the nature and complexity of the auditory and linguistic information provided. The session will end with a plenary discussion.

SS15-02

Understanding auditory effort by measuring cognitive spare capacity

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Cognitive spare capacity (CSC) is residual cognitive capacity once successful listening has taken place. CSC measures may thus provide an indirect measure of auditory effort. We are developing three measures of CSC for research and clinical use: a dual task procedure using audio recordings of HINT sentences, the Auditory Interference Span Test (AIST) using audio recordings of the Hagerman sentences, and the CSC Test using audiovisual recordings of two-digit numbers. In the dual task procedure, sets of eight sentences were presented. Final words were repeated after each sentence and recalled after each set. Hearing impaired listeners showed better recall of early and late than mid set items (classic serial position curve). Cognitive speed underpinned performance in noise and silence and working memory capacity influenced performance both in noise and as a function of hearing aid noise reduction. In the AIST, sentences were presented in sets of three and recall ability tested with increasing cognitive load. Listeners with normal hearing showed decreasing accuracy with increasing cognitive load and longer reaction time at maximum cognitive load. Perceived listening effort was independent of cognitive load. In the CSC Test, numbers were presented audiovisually or as audio only in sets of 13 and recalled in accordance with instructions inducing differential executive load. Listeners with normal hearing performed worse in audiovisual conditions and on updating and high load. The magnitude of the between-modality difference in reaction times was predicted by executive ability. Together, these findings show that it is possible to measure CSC in persons with and without hearing impairment and that its properties can be understood in terms of cognitive function. All three tests will be further developed as tools for understanding auditory effort as a function of cognitive spare capacity.

SS15-03

How the eyes betray what we hear: Pupillometry as an objective measure for listening effort

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[2] *Linnaeus Centre HEAD, Sweden; Linköping University, Sweden*

Background: Mental effort during listening is a major complaint of people with hearing difficulties leading to adverse societal consequences. Pupillometry is a well-validated objective method to quantify mental effort. Pupil dilation reflects effortful cognitive processing, which is related to task difficulty and cognitive capacity. Three studies on pupillometry in relation to performance on speech perception in noise will be discussed.
Method: In these studies, participants performed an SRT task while pupil responses were recorded. With this method, processing load during listening can be investigated separately from performance on speech perception. The studies examined the effect of speech intelligibility, absolute sound level ranging from 45 to 85 dB(A), and different masker types on mental effort.
Results: The outcomes showed stronger pupil dilation in response to lower speech intelligibility. Additionally, there was no influence of different noise levels on mental effort during speech processing, when intelligibility levels in noise were fixed. Finally, the results showed stronger pupil dilation in response to an interfering speaker compared to meaningless (stationary or fluctuating) noise, whereas no large differences were observed in performance.
Conclusions: These results indicate that differences in speech to noise ratio affects mental effort required for speech processing. This effect is independent of the absolute sound levels at which speech and noise are presented. Ignoring an interfering speaker required more mental effort than filtering out meaningless noise, even when performance is the same. This difference between performance and mental effort underlines the importance of including measurements of pupil dilation as an independent index of mental effort during speech processing. Future pupil research will help us better understand the impact of individual cognitive processes like working memory, attention, and language processing on mental effort.

SS15-04

The effort expended to recognize audiovisual speech in noise: A comparison of older and younger adults with normal hearing

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Purpose: Listening in noise is challenging for many older adults. We hypothesized that even with the addition of visual-speech cues older adults would exert more listening effort than younger adults. Listening effort involves the attentional and cognitive resources required to understand speech. The purpose was: 1 – to quantify the amount of listening effort young and older adults expend when they listen to audiovisual speech in noise, and 2 – to examine the relationship between self-reported listening effort and the dual-task measures.
Method: A dual-task paradigm was used to objectively evaluate the listening effort of 25 youger and older adults. The primary task involved a speech recognition test performed in noise and the secondary task consisted of a vibro-tactile pattern recognition test. Participants performed each task separately and concurrently under two conditions of noise: 1 – when the noise level was the same for all participants, and 2 – when the level of noise presented to the older participants was reduced so that the older participants obtained performance levels that were equal to those of the younger participants.
Results: Older adults expended more listening effort than the younger participants, under both listening conditions. Ratings of listening effort did not correlate with the dual task measures. Conclusions: older adults require more processing ressources than young adults to recognize audiovisual speech. Dual task measures can validate older adults' subjective ratings of listening effort across listening conditions.

Current aspects of tinnitus research

Moderators: Birgit Mazurek, Agnieszka J. Szczepek, Grazyna Bartnik

Speakers:
1. **Rich Tyler** • Understanding and identifying different subtypes of tinnitus
2. **Gerhard Hesse** • Hearing therapy and acoustic stimulation with tinnitus and hyperacusis
3. **Agnieszka J. Szczepek** • Current aspects of tinnitus research

SS16-01

Understanding and identifying different subtypes of tinnitus

Tyler R.

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Tinnitus is a symptom, and it is likely that many subgroups exist. Different subgroups can be based on likely etiology, tinnitus characteristics, tinnitus psychoacoustics and cluster analysis. Etiological subgroups include noise exposure, aging, head injury, neck injury, Meniere's disease, and drug specific ototoxity. Tinnitus characteristics include its description, location and duration. Tinnitus psychoacoustics includes post-masking effects, ipsilateral and contralateral masking, and frequency-specific tonal masking. Preliminary results using cluster analysis suggests that the presence of hyperacusis and tinnitus handicap severity might also represent subgroups.

SS16-02

Hearing therapy and acoustic stimulation with tinnitus and hyperacusis

Hesse G.

Tinnitus-Klinik in Bad Arolsen

Tinnitus and hyperacusis are mainly triggered through plastic changes in the auditory cortex, although they generate primarily from cochlear damage. The missing auditory input induces maladaptation and irregular patterns in the cortex. Acoustic stimulation especially of missing frequencies, mainly by modern hearing aids, proves to be an integral part of tinnitus therapy. But also an active hearing therapy plays a crucial role by stimulating inhibition and habituation. Especially in hyperacusis, were inhibition in the auditory pathway is widely diminished, an effective desensitisation is achieved by active hearing exercises. We report data of 104 patients being treated in 2010, where effective strength of treatment was 2.24. Details of the applied hearing therapy are described and data of hearing-aid effects on tinnitus therapy are presented.

SS16-03

Current aspects of tinnitus research

Szczepek A.J., Mazurek B.

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Background: In recent years, in addition to neurophysiology and acoustics, basic tinnitus research started to be supported by molecular biology and biochemistry. These scientific disciplines enable precise pinpointing of molecules and pathways that are involved in either onset or support of tinnitus on molecular level. The interest in field is to correlate changes in gene (and protein) expression with functional changes occurring in auditory system.
Methods: Stress was induced in Wistar rats (4-6- weeks old) by a 24-h exposure to a rodent repellent. Small animal audiometry (of auditory brainstem responses and distortion product otoacoustic emissions) was performed before, and 0, 3, 6, 24 hours and 7 days after finishing stress. Serum was collected and assayed with ELISA for the presence of TNF-alpha and stress hormones (corticosterone). Tissue samples were taken from cochlear epithelium, spiral ganglion and inferior colliculus and processed to obtain RNA. Relative gene expression of glucocorticoid receptor and of prestin was assessed using quantitative RT-PCR.
Results: Stress elevated corticosterone and tumor necrosis factor alpha concentration in serum 3 and 6h post-stress. Stressed animals had decreased thresholds and increased amplitudes of auditory brainstem responses and distortion product otoacoustic emissions. Glucocorticoid receptor gene expression measured by qRT-PCR was elevated in colliculus inferior but not in spiral ganglion or in the cochlear epithelium. There was also increase in prestin mRNA in cochlear epithelium.
Conclusions: Our results implicate that stressful conditions can directly influence functioning of auditory hair cells (increase of prestin expression) and can possibly affect auditory pathway by the expression of proinflammatory cytokines and via elevated concentration of corticosterone.

SS17

Tinnitus: neuroscience and new treatment concepts

Moderator: Pim van Dijk

Speakers:
1. **Pim van Dijk** • Functional magnetic resonance imaging of tinnitus
2. **Marlies Knipper** • Molecular mechanisms of tinnitus
3. **Bernhard Schick** • EarView: An otoendoscope offering new perspectives for the treatment of inner ear disorders
4. **Paul van de Heyning** • Tinnitus relief after cochlear implantation in single-sided deafness

SS17-01

Functional magnetic resonance imaging of tinnitus

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Every conscious percept must be based on neural activity in the brain. This includes subjective tinnitus, which is a sound percept in absence of an acoustical sound source. Tinnitus is believed to be based on mal-adaptive plasticity in the brain e.g. in response to peripheral hearing loss. The fact that tinnitus does not arise in all hearing-impaired patients suggests a difference in brain function between tinnitus and non-tinnitus subjects. We performed a series of functional and structural MRI studies in tinnitus patients: A study of gaze-evoked tinnitus showed a first-order correlation between hyperactivity in the auditory cortices and tinnitus loudness. An anatomical study using voxel-based morphometry (VBM) showed a correlation between tinnitus and gray-matter volume. These two studies suggested a differential role in tinnitus for the right and left auditory cortices, respectively. The VBM study, in which control and tinnitus subjects were strictly matched in hearing loss, shows that anatomical characteristics of the brain possibly determine whether a subject with hearing loss develops tinnitus. However, these characteristics may also be caused by tinnitus. Finally, a study of sound-evoked neural brain responses showed differences in neural activity between tinnitus subjects with near-normal hearing and normal hearing controls. The results were consistent with either increased excitation or decreased inhibition in the brain of the tinnitus subjects. We conclude that a number of structural and functional changes in the brain are related to tinnitus.

SS17-02

Molecular mechanisms of tinnitus

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Tinnitus is a common audiologic complaint characterized by auditory perception without an external physical source. About 10% of the American and European population are subjected to chronic, persistent tinnitus that dramatically affects quality of life. Tinnitus, due to a broad variety of possible etiologies and pathogeneses, is one of the most challenging clinical problems (Eggermont, 2007). However, the molecular basis of tinnitus is still elusive. In most cases, tinnitus can be linked to a damage to the peripheral hearing system (Sindhusake et al., 2004), probably even in cases where an impairment cannot (yet) be assessed by audiometry (Shiomi et al., 1997). Considering the likelihood of hearing impairment in subjects with tinnitus, why does hearing loss NOT automatically lead to tinnitus? The only way to answer this question is to distinguish tinnitus specific features in animals with and without tinnitus, both suffering from hearing loss after equal sound exposure. A direct comparison of hearing impairment with and without tinnitus has never been performed. In the present study we compared equally acoustically exposed rats with similar hearing impairment, that were behaviorally selected (Rüttiger et al., 2003) in groups with and without tinnitus. In a comprehensive study, we were looking for tinnitus specific changes including the cochlea, the auditory pathway and the auditory cortex. Striking results did show up, that may suggest a novel tinnitus specific trait.

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SS17-03

EarView: An otoendoscope offering new perspectives for the treatment of inner ear disorders

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Background: Local application of drugs to the round window membrane (RWM) has emerged as a promising treatment concept of inner ear disorders including tinnitus. This development is particularly driven by both the recent discovery of novel drugs and the availability of preparations for sustained release to the cochlea. However, tools for a minimally-invasive, repeatable and exact placement of pharmaceutical agents on the RWM are still lacking in clinical practice.
Therefore, the Aim of the present study was to design a mini-otoendoscope for a minimally invasive, high-precision application of drugs to the round window niche.
Methods: Based on a modular endoscope system (PolyDiagnost, Pfaffenhofen, Germany), the authors developed a mini-otoendoscope with a working channel and tools for minimally-invasive procedures at the round window niche (EarView). This system was tested in a first feasibility study.
Results: Using a 10,000 pixel optical system providing a 120° field of view, an optimal visualization of the promontory and the round window niche was achieved via a paracentesis. Mucosal folds blocking access to the RWM were removed by a little forceps which was introduced through the working channel. Following exposition of the RWM, gels and fluids were applied to the RWM under visual control.
Conclusions: The newly designed mini-otoendoscope offers the perspective of translating the recent advances in the fields of neuroscience and biotechnology concerning the treatment of inner ear disorders into clinical practice. Due to the modular design, a modification of the otoendoscope for various applications is possible.

SS17-04

Tinnitus relief after cochlear implantation in single-sided deafness

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Introduction: Severe tinnitus can seriously impair patients in their activities in daily life and reduce quality of life. Treatment options for tinnitus in deaf ears are limited.
Porpose: The aim of this prospective clinical study was to assess the long-term effects of Cochlear Implantation (CI) on tinnitus and on tinnitus distress in patients with single-sided deafness (SSD) and ipsilateral incapacitating tinnitus.
Material: 29 subjects participated in this study. Patients suffered from severe tinnitus of more than 6/10 on a Visual Analogue Scale due to unilateral deafness. CI was performed with the electrode fully inserted into the scala tympani. Nineteen of these subjects had normal hearing (NH-group) on the contralateral side, and ten used a hearing aid (HA-group) contralaterally.
Methods: Tinnitus assessment consisted of a tinnitus loudness estimation by means of a Visual Analogue Scale (VAS) and a Tinnitus Questionnaire (TQ) that was conducted pre-implantation and at regular intervals up to 48 months post implantation (n=20). Subjective improvement in daily situations was evaluated using the Speech, Spatial and Qualities Hearing Scale (SSQ).
Results: All 29 patients reported a subjective benefit after CI. Tinnitus loudness reduced significantly with CI from 8.9 to 2.7 on the VAS (of 0-10). Also the TQ total score decreased significantly, the mean tinnitus degree decreased from severe to mild. The amount of tinnitus loudness reduction continued to remain stable up to 4 years after CI.
Conclusions: CI causes a significant and durable tinnitus relief in patients with severe tinnitus and SSD.

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Free Papers

FP-001

Double-blind assessment of tinnitus relief induced by chronic electrical stimulation of auditory cortex (Acousco)

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Introduction: Between June 2007 and August 2009 nine patients suffering from intractable tinnitus underwent neurosurgical implantation of a Medtronic® device on the dura of the auditory cortex. Tinnitus intractability was guaranteed by a Tinnitus Handicap Inventory (THI) score remaining high over at least one year in spite of optimal acoustical and psychological therapy. A further criterion for inclusion was unilateral (or predominantly unilateral) tinnitus perception. The device was systematically implanted on the side opposite to tinnitus. None of these patients had a hearing loss exceeding 60 dB HL.
Methods: Baseline assessment of tinnitus handicap was performed a few weeks or days before surgery. Three scales were used: THI, Tinnitus Handicap Questionnaire of Iowa (THQ), and the Mini Tinnitus Questionnaire (MiniTQ), the latter being normalized to 100% for purpose of comparison with the two other tinnitus questionnaires. In addition, another scale was used to assess existence and magnitude of hyperacusis, the Multiple Activity Scale Hyperacusis (MASH) handicap scale. Fitting of each implanted device was started in the days following surgery and repeated weekly by the neurosurgeon until an effect on tinnitus was observed. Apart from the first patient, an approximate period of 4 months was tolerated to find optimal fitting. Thus the average time needed to identify optimal fitting and start randomization was 140.8 days (range 210–15).
Randomization: Except for patient 9, in whom no tinnitus relief was achievable during the fitting trial, all patients received successive and randomly ordered two programmes of stimulation, each of 15 days and separated by a 15 days interruption. One programme was an electrode combination found to provide some tinnitus change in the fitting trial, the other stimulation strategy serving as control. Before starting the first randomly assigned strategy, stimulation was interrupted for at least 15 days, frequently one month. The assessment of tinnitus handicap, audiometric thresholds and pitch-loudness matching were all performed in double-blind.
Main outcome measure: a THI score shift of 30% from the baseline value was considered clinically significant. The same criterion of 30% was applied to all other handicap scales as threshold of significance. With the two scales that were originally not expressed in percentage (MiniTQ and MASH), an adjusted value was calculated based on the maximum possible score (48 and 10, respectively).
Results: 1) Preoperatively, individual THI scores ranged from 96 (greatest handicap) to 60 (smallest handicap) and an average value of 71.1 was observed in the study group. THI scores were well correlated with adjusted MiniTQ values, suggesting that the two types of scales explore similar dimensions in tinnitus suffering. THI scores were on average 10% higher than THQ scores, the difference being attributable to the relatively well preserved hearing function in our study group. 2) Postoperatively, a significant improvement in THI score was observed in only half of the eight subjects in whom fitting trial was conclusive. In 2 of these 4 subjects, a significant reduction in THQ, adjusted MiniTQ and adjusted MASH was also found. These self-assessed handicap changes, as well as audiometric hearing thresholds and pitch-loudness matches, will be discussed in light of the disclosed cross-over paradigm. 3) Finally, the singular observation in patient 9 will be discussed from a broader prospect.

FP-002

Is adaptation of cortical evoked auditory responses impaired in patients with hyperacusis?

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Hyperacusis is a condition in which individuals perceive ordinary environmental sounds as excessively loud. The aim of this study was to explore the hypothesis of reduced adaptation (disinhibition) at the cortical level, increasing the gain of afferent auditory signals and resulting to abnormal loudness growth that characterises hyperacusis.
Thirty subjects underwent preliminary investigations, including pure-tone audiometry, tympanometry, recording of stapedial reflex thresholds and transient evoked otoacoustic emissions and the medial olivocochlear suppression test, to ensure the structural integrity of the auditory periphery and comparable distal efferent pathways. Twelve patients and thirteen control subjects fulfilled the study criteria and were enrolled for further tests using the cortical evoked auditory responses. The characteristics of N1-P2 complex (N1-P2 amplitudes, change in N1-P2 amplitude between blocks, intensity dependent amplitude response, N1 and P2 latencies, change in N1 and P2 latency between blocks and the N1 and P2 latency/stimulus intensity relationship) were examined in 3 successive blocks of 40 averaged responses elicited by binaural repetitive 1000Hz tone bursts delivered at 40, 50, 60 and 70 dB SL.
The N1-P2 amplitudes showed a clear trend for larger N1-P2 amplitudes in patients at every intensity, but differences failed to reach statistical significance, except for the three-block global average value at 60 dB, with higher values in patients than controls (p=0.01). The intra-group analyses showed increased P2 latencies between blocks in patients at 40 dB SL, with marginal significance (p=0.05). The inter-group analyses indicated marginally longer P2 latencies in patients in block 1 at 60 dB SL (p=0.06), while significantly longer in patients than in controls for the global average at 60 dB SL (p=0.04).
The results of this study support the hypothesis of an increased auditory gain at the cortical level, however, further studies with a larger number of subjects are necessary.

FP-003

How stress affects the function of inner ear and auditory pathway in normal hearing tinnitus patients?

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Introduction: There are about 20% of our tinnitus patients that have audiometrically normal hearing threshold. A number of health conditions can cause tinnitus in that group. We often observe that long-term stress or anxiety states, by chemical and physical changes, can influence many vital functions inducing also hearing disorders, particularly tinnitus.
Objectives: The purpose of this study was to determine how stress as a potential cause of tinnitus can affect the function of ear in normal hearing tinnitus patients.
Methods: The material consisted of 93 individuals (33 control adults without tinnitus and 60 tinnitus patients) with normal hearing threshold (better than 25 dB HL for all tested frequencies: 0.25, 0.5, 1, 2, 3, 4, 6, 8 kHz.), normal middle ear function (type A tympanograms and acoustic reflexes present at normal limits), ABR latencies within normal limits, and did not have any head or neck injury. Distortion product otoacoustic emissions (DPOAEs) were measured in low-noise ambient conditions at frequencies 0.5, 0.75, 1, 1.5, 2, 3, 4, 6, and 8 kHz. The synchronized spontaneous otoacoustic emission (SSOAE) spectra were also collected. To distinguish the level of stress in all participants Perceived Stress Scale – PSS 10 was used. The subjects were divided into three groups: normal hearing control (nh), tinnitus patients (tp) and patients that specified stress as the cause of tinnitus (tps).
Results: There were no differences between the DPOAE levels for groups nh and tp. However DPOAE levels for group tps were significantly lower than in nh and also in tp. This difference was especially prominent in 6 and 8 kHz – around 6 dB. There were also less SSOAEs detected in group tps than in nh and tp.
Conclusions: Our results suggest that stress may specifically affect high frequency areas of hearing.

FP-004

Psychoacoustics and neural correlates of gaze evoked tinnitus

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The goal of this study was to identify mechanisms that underlie gaze evoked tinnitus (GET). GET was investigated in 18 subjects who underwent surgical removal of a tumour in the cerebellopontine angle. They all perceived tinnitus that was modulated or evoked with peripheral gaze. Nine control subjects were included. A questionnaire, psychoacoustics and functional magnetic resonance imaging (fMRI) were used in this study.
The tinnitus percept and modulations were matched in loudness, pitch and bandwidth to a sound presented at the contralateral ear. The gaze-evoked tinnitus changes were highly variable across subjects. Typically, the perceived modulations comprised increases in loudness and pitch and decreases in bandwidth. In general, the largest modulation was induced by gazing laterally to the side of surgery.
Functional MRI measurements revealed significant neural activity in parts of the brain that are related to sound perception and peripheral gaze (FWE corrected $p<0.05$). Region of interest analyses showed deactivation of the auditory cortex during peripheral gaze both in controls and in tinnitus subjects, for gaze directions that gave no or only minor modulation of the tinnitus. In contrast, when the loudness increase of the matched sound with peripheral gaze was sufficiently large, activation in the auditory cortex was observed to increase. This increased activity was present in Brodmann areas 41, 42 and 22 and in the basal ganglia ($p=0.0001$, $p=0.004$, $p=0.01$ and $p=0.04$ respectively).
These results show that tinnitus loudness is represented by neural activity in the auditory cortical areas. Both the primary and the associative auditory cortices show increased activity with increasing tinnitus loudness.

FP-005

Distortion Product Otoacoustic Emissions (DPOAEs) in normally hearing patients with bilateral tinnitus and in non-tinnitus controls

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Even though tinnitus is most frequent in individuals with hearing loss, some tinnitus patients have normal audiograms. The presence of a limited area of damaged outer hair cells (OHCs), which might not be detected in the audiogram, with intact inner hair cells may result in unbalanced neural activity between Type I and Type II fibers leading to tinnitus. In patients with clinically normal audiograms, DPOAEs may detect subtle OHC damage. Thus, DPOAEs may be useful to evaluate cochlear mechanisms accompanying tinnitus. However, reports on DPOAEs in normally hearing tinnitus patients when compared to non-tinnitus controls are inconsistent. Impairment of OHCs in the most basal region may reduce contributions to more apically generated DPOAEs. The extended high-frequency (EHF) audiometric data for tinnitus patients are limited. The present study evaluated DPOAEs and EHF thresholds in patients reporting bilateral tinnitus of greater than 6-months duration and in non-tinnitus controls. All individuals (age ≤40 yrs) had hearing thresholds ≤20 dB HL up to 8 kHz and ≤70 dB HL at 10, 12.5, 14, and 16 kHz. The DP-grams were measured in the 0.5–8 kHz range using 65/55-dB SPL primaries. In both groups, median audiometric thresholds for left and right ears were highly symmetrical. Median EHF thresholds were slightly elevated in tinnitus patients compared to those in the controls. In both groups, mean DPOAE levels in left and right ears were symmetrical. At some primary frequencies, mean DPOAE levels were marginally lower in tinnitus patients than those in the controls. The results indicate that bilateral tinnitus may arise from peripheral pathology neither detected on the conventional audiogram nor by a screening DP-gram and/or from retrocochlear activities, possibly involving multi-crossed auditory pathways. Local OHC impairment not reflected by DPOAEs may be present together with other subclinical pathologies, e.g., loss of normally high-threshold spiral ganglion cells, resulting in tinnitus.

Study supported by grants from Tinnitus Research Initiative, Institute of Physiology and Pathology of Hearing, Warsaw, Poland, and The Polish Ministry of Science and Higher Education (N N403 538739).

FP-006

Troublesome tinnitus in children – epidemiology, audiological profile, preliminary results of treatment

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Introduction: Although tinnitus has often a significant impact on individual's live, there are still few reports relating to tinnitus in children. In our Tinnitus Clinic, children with distressing tinnitus constitute about 0.5% of all our patients.
Objectives: The aim of this study was to analyse children with troublesome tinnitus as regards epidemiology, audiological profile and preliminary effects of the therapy seen in our clinic in 2009.
Methods: A retrospective study was carried out involving the cases of 143 children consulted in our Tinnitus Clinic in 2009. The selected group with troublesome tinnitus was evaluated and classified for proper category of TRT.
Results: The study showed that 41.3% children suffered from bothersome tinnitus. In this group 44.1% of patients demonstrated normal hearing. The success of therapy after 6 months was estimated on 81.4% of significant improvement.
Conclusions: It is recommended to include to a questionnaire an inquiry about the presence of tinnitus during hearing screening tests.

FP-007

Asymmetric hearing loss and use of two hearing aids

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Background: Bilateral amplifications is more physiological and much more effective comparative with respect to monaural, binaural electroacoustic correction is prefered in all whenever possible cases.
Aim: The aim of our study was to establish the possibility of bilateral amplifications for patients with asymmetric hearing loss.
Methods: We observed 84 patients with chronic sensorineural and mixed hearing loss having difference in audiometric data the average hearing loss exceeded 25 dB. The patients were of the age 21 to 76, including 39 women and 45 men. 56 (67%) patients used a hearing aid, with the prosthesis on better hearing ear. All patients, regardless of prior experience conducted a sound lateralization test of using speech material in the form of words, phrases and sentences.
Results. The results of bilateral fitting found out that the majority of patients achieved a binaural loudness balance. 12 (14%) patients, prosthetic monaural, noted the different perception of sounds when the hearing aid set up. That was interpreted by us as a symptom of sensory deprivation.

Conclusions. Successful binaural hearing rehabilitation depends on the optimal use of residual hearing. Using the possibilities of bilateral fitting will increase efficiency of rehabilitation measures in patients with asymmetric hearing loss.

FP-008

Mini microphone: Minimizing noise for maximum understanding

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GN ReSound AS

Listening situations are not one uniform kind of situation. On the contrary, hearing-impaired individuals and hearing aid users like other listeners find themselves listening to speech in background noise in a myriad of different listening situations. Speech perception in background noise is the primary hearing aid user complaint.
Directionality is known to address this problematic listening situation, but it doesn't provide benefit when the location of the speech/signal(s) of interest is not in front of the listener, the speech/signal distance is far and the noise location is not in the back.
Wireless transmission is not new, but digital wireless transmission provides new possibilities within the area of hearing solutions. A mini microphone solution that works with the 2.4 GHz ISM digital wireless transmission and addresses the hearing in background noise complaint has been developed and validated. Speech reception thresholds (SRT) have been tested to ascertain improvements afforded by the mini microphone in the mini microphone setting alone and in a combined mini microphone and hearing aid microphone setting. Comparative testing has been performed using an adaptive directional setting. Speech reception thresholds were also tested in a specialized test setup taking into account a speaker at different distances. The test subjects were all experienced with amplification and were all fitted with a MBTE using closed ear moulds with venting based on individual hearing loss. The Dantale II test material was used. Test conditions and test distances were randomized for each test subject to avoid an order effect. The best Speech Reception Threshold scores were observed with the mini microphone activated followed by the combined mini microphone and hearing aid microphone setting.

FP-009

Custom made "High-Tech-Earmolds" – short-vent-design and earmolds with (air) pressure equalization effects

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A great deal has changed since the first digital hearing aids came on the market in 1966, particularly in the area of custom (ear) mold design:
- About 90 percent of users are fit with custom molds with short-venting or are provided with an "open" mold;
- Molds with slimtube- and RIC-systems have already replaced molds with the "normal" sound tube (2.0×3.1 mm);
- Industrially produced standard domes now promote the "hearing aid-to-go";
- Deep in the ear canal devices are replacing MIC-systems.

These developments are not only the product of more advanced technology, but are especially based in better understanding of the anatomy, morphology and movement patterns of the concha and the external auditory canal. Consequently, it takes a specialist with unique knowledge about earmolds to refine the industrial raw product "hearing aid" to a hearing system which with optimal success results in the best possible speech understanding and a high acceptance rate with continuous wearing of the device.
In addition to using custom ear molds for the hearing impaired, these items can also be used in other applications:
- Many divers report problems with clearing their ears while descending and often these people are suffering because of a so called "swimmer's ear";
- Another group reporting difficulty with pressure equalization is the long-distance flight passenger; especially when the aircraft is landing;
- Military pilots also report these difficulties when diving and turning aircraft during dog-fight maneuvers.

It is suggested that these groups can be helped with special custom molds.

This presentation will critically discuss the quality management, hygiene and product safety of custom earmolds for the various uses cited, with particular reference to:
- "Standard" vs "high-tech custom made" molds;
- Different short-venting designs for RIC-, slimtube- and ITE-systems;
- A metal grommet sleeve: high-tech-solution for slimtube-aids;
- A field report about custom molds with (air) pressure equalization effects and preventive characteristics for divers and those involved in flying.

FP-010

Zoom, Zoom, Zoom… improved intelligibility with directionality

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Phonak AG

Recent studies showed that speech intelligibility in demanding noise environments is still one of the most dominant problems for people with a hearing loss. Nowadays, directional benefit from multi-channel beamformer algorithms combined with intelligent adaptations to the target of interest lead to high spontaneous acceptance coupled with increased speech intelligibility and ease of listening in difficult listening environments.
To evaluate appropriate spatial noise reduction systems, improved beam former algorithms were compared to state of the art noise reduction systems. To determine speech intelligibility, speech sentence tests and subjective sound quality, ratings were performed to address the above mentioned questions. To simulate numerous listening situations, different target signals and noise configurations were tested. Signal and noise were presented from the front, from the side and/or from the back. Results showed high spontaneous acceptance based on the increased ability of ease of listening. Thus, it has been shown that enhanced ease of listening was achieved through optimized beam former algorithms.

FP-011

Laboratory evaluation of directional preference: Effects of stimulus type and location

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Directional benefit has been unequivocally demonstrated to improve speech understanding in background noise in the laboratory. However, real-world directional advantage can be best described as lukewarm. Studies have shown that success with directional microphones cannot be reliably predicted from laboratory measures of directional advantage. While surveys of hearing aid users indicate that 38% are dissatisfied with, and 95% desire improvement in, the performance of hearing aids in noisy situations, the prevalence of directional microphones in the marketplace is only ~25%. Nonetheless, the good news is that hearing aid users do report a directional advantage in several environments. The disconnect between laboratory and real-world findings is typically attributed to the acoustics of the environment. This includes: (1) the presence, location and distance of signal and noise, (2) reverberation, and (3) typical input levels. It is conceivable that the hearing aid wearer's internal criterion in a particular listening situation would influence directional preference. That is, some situations may result in conflicting outcomes depending on whether maximizing speech understanding or optimizing listening comfort is most important to the individual. Preferences may further be confounded by binaural considerations. Specifically, in some situations, omnidirectional may be preferred in one ear while directional is preferred in the other. The effects of these factors were assessed in the laboratory by 20 adults with mild-to-moderate sensorineural hearing loss. Participants were fitted bilaterally with BTEs. Directional benefit in daily life is often assessed on the basis of the patient's response to "Which program did you prefer?" In keeping with this theme, subjective preference for directionality was evaluated in a paired-comparison format using standard laboratory (i.e., controlled) and simulated real-world stimuli. Various configurations of speech and noise location were used. Bilaterally symmetrical and asymmetrical settings were judged. Finally, preferences for optimized speech understanding and maximized listening comfort were obtained separately. The preference data were analyzed using the Bradley-Terry model. The results and their clinical implications will be discussed.

FP-012

Aided spatial hearing: Electroacoustic and perceptual considerations

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GN ReSound

Communication in complex listening environments is a challenging perceptual task, especially when the auditory system has become compromised. One essential component to communication is the ability to localize sounds in space, and spatial hearing under conditions of amplification has recently become a topic of interest. Traditionally, spatial cues are described by the Interaural Level Difference and the Interaural Time Difference, whose basic effects are well known. Spatial hearing is multidimensional, however, and easily affected by amplification. This paper explores some of the factors that influence spatial hearing, including ILDs, ITDs, Direction of Arrival and other estimates derived from the Head Related Transfer Function. It also summarizes the effects of processing delay, synchronization, beamforming and compression that can affect the perception of spatial cues.
Spatial cue signal processing has been acoustically investigated using devices from several manufacturers. Pairs of devices were programmed according to manufacturer's recommendations and tested using the International Speech Test Signal (ISTS). Two standard audiograms from the ISMADHA working group were evaluated, one in an "open" configuration and the other in a closed configuration. This phase of testing was conducted on KEMAR.
Spatial hearing was also investigated in a perceptual study conducted at the University of Oldenberg. Speech in noise performance and spatial awareness were evaluated for signals positioned at various angles in front of the listener. Testing was again conducted using pairs of devices from several manufacturers.
The combined results of these two investigations are intended to gauge the effectiveness of currently available spatial cue signal processing strategies and in general to identify methods that may have potential with regard to spatial hearing. While several manufacturers will be represented in the data the identities of individual products or manufacturers will not be disclosed.

FP-013

How well can adults manage a self-fitting hearing aid?

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There is a deficit in developing countries in both the provision of hearing aids and the number of hearing health care providers who are skilled to fit them. One potential way to overcome this problem is to introduce a self-fitting hearing aid, an amplification device that users can program themselves without the need for a previous audiogram, direct input from an audiologist, or access to a computer. The study presented in this paper investigated how well hearing-impaired adults can assemble and manage a hearing aid from a set of instructions written at a third-grade reading level. A secondary aim of the study was to obtain information about the general perception of a self-fitting device. The concept of a self-fitting hearing aid was presented to 80 adults between 45 and 90 years of age and their opinion about the concept sought through a structured questionnaire. Afterwards, the participants were asked to assemble a potential prototype of the device from a selection of parts that included the body of a behind-the-ear instrument, tubes, and instant-fit ear tips in different lengths and sizes. Specifically, the study focused on the extent to which the participants could choose the correct tube and ear tip size, assemble the parts into a complete hearing aid, insert a battery, place the device in the ear, and press a button to activate the fitting procedure, whether on their own or with the assistance of an attendant partner or friend. Additional data such as demographic information, past experience with hearing instruments, cognitive function, manual dexterity, visual acuity, and health literacy levels were collected and used to investigate possible barriers to accessing a self-fitting hearing aid. On the basis of data analyses currently in progress outcomes from this study will be presented and discussed.

FP-014

Trainable hearing aids: What do we know about them?

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A trainable hearing aid is a device that users can train to provide individually preferred settings in a variety of listening environments. Using one or more controls, the hearing aid user changes hearing aid settings in their own environments, and a memory in the device collects and stores information about the user-selected settings together with the acoustic input of the listening environment. When sufficient data have been accumulated, a training algorithm begins to make predictions about the user's preferences in different listening environments, and continues to refine these predictions as additional input from the user is received. Trainability is a feature that is currently available in a number of hearing aid models. With the focus on a training concept developed and evaluated at the National Acoustic Laboratories in Australia, this talk will present and discuss what is currently known about the potential of trainable hearing devices as well as their limitations. Various studies have been conducted to investigate: 1) How reliably hearing aid users can select their preferred response, 2) How many controls are needed and which manipulations users should be able to make, 3) If the baseline response significantly affects the trained response, and 4) How hearing aid users perceive trainability. Overall, data from such studies show that hearing aid users can reliably select different responses in different environments using different control configurations, as long as the starting point is an appropriately prescribed response. Generally, hearing aid users like the idea of training their devices, but they prefer a short training period and simple controls that include a volume control.

FP-015

Optimizing both speech intelligibility and spontaneous acceptance: A challenge

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When asked about their motives for considering a hearing instrument, the hearing impaired most often state "better speech understanding" as the main motive. Regardless of the improved signal processing algorithms (e.g. noise reduction methods), a quest for achieving noticeable improvement in speech understanding with a hearing aid still requires of the acoustician to apply a noticeable increase in amplification. This is particularly true for speech in noisy environments. The resulting hearing aid fit is often experienced as unpleasant and too shrill, and in some cases it still does not result in the expected improvement in speech intelligibility. The challenge in hearing aid fitting, therefore, is to maximize both speech intelligibility and spontaneous acceptance, or at least to find the optimum balance between the two for each individual hearing impaired person. On the basis of new study results we shall present some guidelines as to how to reach this goal with modern prescriptive fitting formulas (e.g. NAL-NL2, manufacturer-specific formulas).

FP-016

Linear frequency transposition – what works and what doesn't?

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A severe-to-profound high frequency hearing loss may not be aidable with conventional amplification because of the hearing aid's limited gain/bandwidth and the patient's potentially "dead" region in the high frequency. Various approaches to reach audibility through frequency lowering were reported. This presentation examines their efficacies and reports on the lessons learned from recent studies. The factors that are important in ensuring the efficacy of this algorithm will be discussed.

FP-017

Use and understanding of prepositions by children of 3–6 with cochlear implant

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Aim: The aim of our analysis is to define how children with cochlear implant understand and use prepositions and to compare the level of their skills with normal-hearing children.
Material and Method: Material consists of 40 children with cochlear implants, diagnosed with hearing impairment before 3 years of age, using CI for at least 1 year.
Method comprises four tests developed by D. Emiluta-Rozya and K. Kaczmarek-Sowa, three testing use and one for understanding of prepositions.
Results: Based on the results we demonstrate that implanted children achieve worse results of using and understanding prepositions in comparison to their peers with normal hearing, and especially using prepositions is very difficult for them.
Conclusions: The results of research show that implanted children 3–6 years old have difficulties using and understanding prepositions, the after cochlear implantation they are able to learn this part of speech.

FP-018

Evaluation of phoneme discrimnation in cochlear implanted children by lexical neighbourhood testing

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Background: Discrimination of acoustically similar phonemes is essential for speech comprehension. If a single phoneme is wrongly heard the whole message could be misunderstood (Dimic, 2002). Profoundly deaf children experience a lot of difficulties in phoneme discrimination. Cochlear implant could improve speech perception and discrimination in profoundly deaf children tremendously (Tyler et al. 2007, Papsin et al. 2008, Geers et al. 2009)
Aim of the Study: To evaluate the capacity of phoneme discrimination in coclear implanted children.
Material and Method: Fifty profoundly deaf children aged 3 to 12 years were included in the study. Experimental group consisted of 25 cochlear implanted children and control group of 25 children with hearing aids. Both groups were divided in younger and older subgroups regarding age and regarding duration of rehabilitation.
Auditory perception was evaluated through Serbian version of Lexical Neighborhood Test consisting of 40 pair of words differing in a single phoneme. Test material was presented by auditory mode exclusively without any lip reading.
Results: Cochlear implanted children have shown statistically significant advantage in phoneme discrimination as compared to profoundly deaf children with hearing aids ($p<0.05$). Auditory perception was better in older children in both groups. Phoneme discrimination is gradually rising through speech and hearing rehabilitation. Children with less than one year of rehabilitation have shown the worst scores, while the best achievements in Lexical Neighborhood Test were registered after two years of postoperative rehabilitation
Conclusions: Phoneme listening in profoundly deaf children is significantly improved by cochlear implantation. Ability to discriminate similar phonemes is developing over time due to postoperative rehabilitation and cortical maturation.

FP-019

Improving learning ability by music in children with cochlear implants

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Music Research Center

Aim: In this study we have reviewed the feasibility and results of teaching music for implanted children. Music is found to affect the process of learning and thinking. Music develops a positive attitude in the listeners and provides them with motivation.
Material and Methods: In a longitudinal study, all the children who have been undergone cochlear implantation are potential candidates for this training program compared with CI control group.
Results: All children who have entered the music training programs, have significant improvements in their daily communications as well as the desired endpoints.
Conclusions: learning ability will be improved for this group of children. Music training can be, and should be, a part of habilitation programs. We have introduced this approach 11 years ago, and know it is completely incorporated in our routine habilitation program and also in many centers in the world.

FP-020

Experienced cochlear implant listeners profit from structured listening training

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Background: Speech recognition in Cochlear Implant (CI) listeners usually increases during the first years of electric hearing and reaches a plateau usually after 6 to 24 months. However, a number of CI listeners still suffer from hearing difficulties in every day life.
Aim: The purpose of our study was to investigate the effect of a structured listening training on speech recognition in experienced postlingually deafened CI users.
Material and Methods: Eight experienced adult CI users underwent computer based listening training during a period of four weeks. Each subject took part in six training sessions. The training consisted of single phonemes, real words in different conditions (male and female speaker, regular and clear speech). The prsentation sequence went from difficult to understand (phoneme, male, regular speech) to easy to understand (regular word, female, clear speech) until a correct response was given. Speech performance was evaluated by speech audiometry before, immediately after the training and six month after training.
Results: For all subjects significant improvement for the VCV perception during training was observed. Speech audiometry scores increase for all conditions, which was at maximum for the sentence test in moderate noise (SNR=+5 dB). For this situation the average enhancement was 13%.
Conclusions: A structured computer based listening training improves every day life listening capabilities even in experienced CI listeners with above average performance. The individual effort was less than ten hours for the complete training.

FP-021

Parents opinion on speech development of small children

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Introduction: Proper development and use of the potential of parents of small children with cochlear implants in their therapy and rehabilitation have been the motivation to develop new tools for the more effective exchange of information between people involved in the therapeutical process.
Aim: Aim of this study was to compare the parents' observation skills concerning hearing, language and communication abilities of their child between the group of parents of deaf children using cochlear implants and parents of normally hearing children of the same age.
Material and Methods: Material included 20 children with cochlear implants and 20 children with normal hearing as the reference group. Children were between 2–3-years old.
All parents were asked to complete questionnaires developed by speech and language therapists of the Rehabilitation Clinic at our Institute. It comprised open questions covering 5 areas: listening, speech, language, cognition and communication skills.
Parents of implanted children responded to the same questionnaire several times during the first year after the implant activation – this study is based on questionnaires completed 1 month after and 12 months after the activation. In case of normally hearing children parents have completed the questionnaire only once.
Results: Parents of the deaf implanted children more often than parents of hearing children select the detailed categories of responses, such as child's reaction to the specific environmental sounds to describe hearing, structure of the statements to describe speech, single words and understanding of statements to describe speech understanding, gesture and gestures connected with speech, crying or shout to describe communications of children. In comparison, parents of hearing children select general categories, e.g. ‚s/he can hear everything'.
Conclusions: There is a significant difference in the manner of children's observation between the group of parents of deaf children using the cochlear implants and the parents of normally hearing children.
Discerning observation of deaf children by their parents is a significant help to the therapist in terms of monitoring of the progress of the hearing and speech rehabilitation. It constitutes a basis for setting short and long term goals for child's development stimulation.

FP-022

Evaluation of dialogues in the parent-infant-dyad with hearing impaired children. A study in Poland

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Background and Aims: Dialogical development begins with the very first day of life in mother/father-newborn relationships. It is composed by several elements of the early dialogue like eye contact, Motherese/Fatherese, vocalizations of the child, dialogical echo of the parent and emotional greeting behavior. This applies as well for healthy as for hearing-impaired children.
The research study (Bagan-Wajda 2006–2011) is incorporated in the research projects of Prof. Dr. Horsch, Germany (2006–2011) and aims to analyze early dialogical interactions of both healthy and hearing-impaired infants and their parents. The main subjects of this research are correlations between the particular dialogical elements and their development during the first 18 months of life as well as their frequency scales.
Method: The research was conducted by the method of observation. Once a month parent-child interactions have been video recorded; starting in the first month of life of the hearing children and from the moment of hearing aid implantation in the hearing-impaired infants.
The recordings were analyzed by the use of a computer software called Interact (Mangold International), which allows a very detailed analysis of the video sequence and the processing of the correlations between particular dialogical elements evaluation
Conclusions: Preliminary research results make it possible to draft a description of early dialogical development in both analyzed groups of infants. Special significance is given to similarities and differences occurring between the developments of particular dialogical elements in case of hearing-impaired children by comparison with the control group, as those results may be used as clues towards creating ideal learning conditions for acquiring language and communication skills in hearing-impaired children.

FP-023

Cochlear implantation and coping strategies in postlingually deafened adults in comparison with the hearing population

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Background: The study concerns the strategies of coping with stress used by postlingually deafened adults using cochlear implants in comparison to the adult hearing population. It could be assumed that those strategies are different as a result of the hearing loss and its consequences, and also that they are modified with time since the moment of the cochlear implantation.
Aims: The question asked was whether the trauma experienced by deafened people in relation with their hearing loss and its consequences modifies their strategies of coping with stress, as compared with the general population of hearing people. The next question concerns the dynamics of the process of adapting to the cochlear implant (and to the deafness) with the passing of time, in this aspect it is interesting whether and how the cochlear implant users change in time their strategies of coping with stress.
Methods: In the evaluation of stress coping strategies was used the Mini-Cope (Carver,1997) questionnaire adapted to Polish. This questionnaire distinguishes 14 strategies, among them are: active coping, positive revaluation, seeking for emotional support or denial. This questionnaire, an information form and a cover letter were sent to about 200 adults implanted in the Institute of Physiology and Pathology of Hearing in 2005 and 2009 (the response rate was 62%). The studies took into consideration such factors as age, sex, marital status, occupational status, the duration of the deafness and others.
Results: The results of this study are presently being elaborated.
Conclusions: The results will allow to create psycho-educational and psychological support programs for patients postlingually deafened, including those who are in the process of deciding about cochlear implantation. These programs will take into consideration their specific ways of coping with stress, especially the stress connected with their deafness and its consequences in many areas of life.

FP-024

Language acquisition in the context of early dialogues. Elements of dialogue that initiate language acquisition

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Background And Aims: From the very first days of life parents get in close contact with their infant and introduce both, people and the world, to the newborn in a mutually dialogical way. In these early dialogues language acquisition begins with the first close relationship between parents and infants. What is the motor for this ongoing process? What happens between infants and parents referring the saving of language acquisition? The research project »Dialogical Development of handicapped and non handicapped Infants« (Horsch et al. 2004–2009) aims to document, to describe and to evaluate the process of the development of important elements of the dialogue that are responsible for language acquisition. The main focus is on Motherese and Fatherese in the first year of life (first 12 month). In the context of other important elements of dialogue such as greeting behaviour, vocalisation, dialogic echo, eye contact and body contact, but also in the context of the situation we aim to show the individual development of dialogues as the most important factor for language acquisition. The active factor of the

hearing screening and with it the active factor of the early capture should be identified by the comparison of early dialogues in both groups (hearing impaired/hearing). Besides, a special attention is directed to the specific parental language as a turn-opening and turn-answering element of the dialogue in the context of language acquisition.

Methods: The empirical data is derived from a longitudinal study during the first 12 months of an infant's life. Data is collected over the first year of life by monthly videotaping of 20 minutes in the natural setting and by the use of questionnaires and developmental tests. In these international studies participants in Germany (n=111), Poland, Finland and the USA (altogether n=260) are taking part; this includes normally developing and handicapped (hearing impaired, Down-Syndrome) infants. Computerized (Interact, Mangold) and statistical analysis (SAS) is implemented for the evaluation of the data.

Results: Concerning the examined dialogue elements highly interesting results can be stated. These appear in particular in the different use of Motherese/Fatherese of parents with hearing-impaired and hearing children. Parents with hearing impaired children speak much longer in Motherese/Fatherese with their infants than parents of hearing children. Besides, several significant correlations between variables of parents and infants (hearing and hearing impaired) and observations referring the context have been evaluated.

Conclusions: The first results give an instruction to the active factor of the hearing screening. In the examined dialogues high potentials can be stated for a usual, hearing-directed language acquisition and early processes of "Bildung" which require other investigations. In conclusion, language acquisition can be located as a dialogical process in which the elements of the dialogue and the context built a interdependency.

FP-025

Enhanced patient care – exploiting the Social Web Environments

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"How mass collaboration changes everything" is the subtitle of "Wikinomics", one of the fundamental books describing the new dimensions of Internet. A well known example is WIKIPEDIA. In millions of weblogs, forums and thousands of social networks (Facebook with 500 Million registered members) people can lead peer-to-peer conversations.

What then is the impact of social web environments on health care and specifically on potentially enhanced patient care?

PEW Research (Washington) has shown that people turn to different sources for different kinds of information. When the issue involves technical aspects related to a health care problem, people prefer to contact professionals (62–91%). When the issue involves more personal/emotional aspects most patients prefer the non-professionals (46–59%).

Communication in Social Web Environments can happen on different levels:

- Inter-disciplinary (e.g. medical doctors, audiologists, speech therapists and psychologists share their core competence knowledge to conclude on the most promising treatment for a patient)
- intra-disciplinary (e.g. audiologists with different levels of education and experience join forces to enhance the quality of diagnosis and treatment for patients with specific problems; parents seeking treatment for their deaf children empower each other by sharing their knowledge and experience leading to "Participatory Medicine")
- supra- or meta-disciplinary (e.g. people access information available in the Internet)

In this presentation we will illustrate how Social Web Environments could be exploited on all different levels during the process of consulting and deciding whether a Cochlear Implant is indicated for a certain child.

We will also describe where this communication and cooperation mode is already applied and list some key criteria for introducing innovations.

Finally we will present a proposal what should be done to encourage the use of Social Web Environments in order to enhance patient care in the field of audiology.

FP-026

An up-to-6 years audiological follow-up of children with congenital cytomegalovirus infection

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Background: Prospective study in Flanders on the outcome of congenitally cytomegalovirus infected children.

Aims: To evaluate the audiological outcome of children with congenital cytomegalovirus infection.

Methods: In a prospective study, the hearing of 97 congenitally cytomegalovirus-infected children, born between January 2003 and July 2009, was systematically evaluated until the age of six, applying the Flemish CMV protocol. Depending on the age of the child, the protocol provides hearing evaluation by objective-, play- or conventional audiometry. Symptomatic children with hearing loss at birth were treated with ganciclovir, if parents consented.

Results: Seventy children had pass on initial screening, 27 had unilateral or bilateral hearing loss. Within the normal hearing group, three children developed late-onset hearing loss. Within the group with hearing loss, 8 children received ganciclovir. Within the treated group, 37.5% of the children had a stable hearing loss, one was progressive and improvement of hearing occurred in 37.5%. Among the untreated symptomatic children, hearing loss remained stable in 50%, while progression occurred in 37.5%. In the group of asymptomatic children with hearing loss, hearing loss was most commonly stable (72.7%).

Within the group of normal hearing ears at birth (n=156), there is a significant better progression in pure tone average for ears of asymptomatic subjects in comparison to ears of symptomatic subjects (p=<.0001). Within the group of ears with hearing loss at birth (n=38), analysis shows no evidence for a difference in pure tone average progression between the different groups (p=0.38).

Conclusions: Cytomegalovirus infection may cause hearing loss, in both symptomatic and asymptomatic children. Our data show a significant worse evolution of hearing of normal hearing ears at birth in symptomatic children. This is not the case for ears with hearing loss at birth. Ganciclovir increases the likelihood of improvement and reduces the likelihood of progression of the hearing loss.

FP-027

Ten-year follow-up of a universal newborn hearing-screening programme

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Objective: To study the long-term outcome of a universal newborn hearing-screening programme based on multiple transient-evoked otoacoustic emissions (TEOAEs) and clinical click-evoked brainstem response audiometry (ABR).

Methods: The study included all the newborns that were screened during a 6-year period (31,092 newborns). In order to study the optimal postnatal period of time for the initial TEOAE test and change in specificity by repeating the test, TEOAE pass percentages were analysed as a function of age at testing, and number of test occasions, including effects of ear and sex. In an assessment performed 10 years after the start of the 6-year universal newborn hearing-screening programme, prevalence, degree, and type of congenital hearing loss were studied.
Results: The proportion of screened newborns was high, 98%. Maximum TEOAE pass percentage occurred at postnatal day 5. Multiple TEOAE recordings minimised the need for clinical ABR – only 0.8% of the screened newborns underwent ABR, while 0.18% (n=57) showed bilateral permanent or long-lasting hearing loss (exceeding ≈30 dB HL) with a median ABR threshold of 60 dB nHL (at 2.5 months of age). Another 0.08% (n=25) revealed permanent or long-lasting unilateral hearing loss. Bilateral and unilateral sensorineural hearing loss was demonstrated in 0.17% (n=52; 56% males) and 0.06% (n=18; 61% left ears; 56% males) of the screened newborns, respectively. Higher TEOAE pass percentages ($p<0.01$) were demonstrated in right ears and in females than in left ears and males.
Conclusions: This universal newborn hearing-screening programme revealed high efficacy. The proportion of congenital sensorineural hearing loss was higher in left ears and in males than in right ears and females which was in line with the systematic ear asymmetries and sex differences in TEOAE pass percentage, resembling pathophysiological differences, at birth.

FP-028

Aminoglycoside-induced hearing loss in newborns – results from UNHS in Romania

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Background: Aminoglycosides (AG) are widely prescribed despite their notorious toxicity, especially for neonatal sepsis in Romania.
Aim: The aim of this study was to demonstrate the importance of newborn hearing screening in early detection of ototoxic-induced deafness in newborns.
Methods: Newborns with risk factors for hearing loss were screened during maternity ward hospitalization with automatic OEA (AOEA) and ABR (AABR), according to the Universal Newborn Hearing Screening (UNHS) National Program protocol. In 34 month period, out of 11.778 screened newborns (NN) from one maternity in Bucharest, 1.131 (9.6%) needed ICU services for 5 to 7 days. 127 (11.2%) NN from ICU unit received ototoxic treatment.
Results: 79 (7%) from ICU-newborns were REFER-ed after first screening. 68 (86%) came for follow-up after one month and 26 (38%) of them REFER-ed for the second time. Just 20 of them went to an audiological center for clinical evaluation of hearing: 12 newborns were diagnosed with hearing loss, by means of clinical impedancemetry, otoacoustic emissions (distorsion product) and electrophysiological measurements (BERA and ASSR).
Conclusions: Protocol used in our National UNHS Program has similar rates in identification of deafness (1.95‰ REFER rate from initial screening) with literature review data.
Out of 11.778 live NN screened for hearing impairment in the maternity ward 73.9% of them had risk factors for hearing loss. Overall incidence of hearing loss in newborns population at risk for hearing loss is 1.06%. From 12 hearing impaired NICU babies, six (50%) newborns were identified with bilateral profound sensorineural hearing loss (SHL), one (8.33%) with bilateral severe SHL, three (25%) with bilateral moderate SHL, one with unilateral severe SHL (8.33%) and one (8.33%) with auditory dys-synchrony.
Administration of ototoxic drugs for more than 7 days has a significant statistical importance in the ethiology of prelingual hearing loss in our study ($p<0.001$).

FP-029

Development and validation of a hearing screening test for occupational medicine

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Background: Audiological screening of noise-exposed workers in Belgium is currently done by means of pure-tone audiometry. However, low correlations have been found between these screening results and profound audiological evaluation.
Aims: This study involves the development and validation of a new automatic self-screening test based on speech intelligibility in noise, with a specific focus on high-frequency loss. Contrary to pure-tone audiometry, speech-in-noise screening tests are expected to be more robust in the often unfavourable conditions such as a noisy environment and a non-professional test administrator.
Methods: Two types of tests – one with digit triplets and one with cvc-words – were developed, both in Flemish and in French. The speech materials were optimized by homogenizing the individual words with regard to their intelligibility. Norms were gathered for 50 normal-hearing listeners. Both screening tests and the traditional pure-tone screening test were then compared to the results of a profound audiological examination in 120 noise-exposed workers.
Results: After optimization, steep slopes at the speech reception threshold (SRT) were found for the reference psychometric functions (>15%/dB). The SRTs were situated around –11 dB SNR, with small standard deviations (<0.8 dB) across the normal-hearing listeners. The test-retest (within-subject) variability of the SRT was within 1 dB. Measurements took less than 5 minutes per ear.
Conclusions: The newly developed tests have steep slopes and a high reliability. Based on the results of the large group of noise-exposed workers, the sensitivity and specificity will be determined for the new screening tests and compared to the traditional pure-tone screening test.
Acknowledgement: "Portions of this study were performed in the framework of the European project "AHEAD III: Assessment of Hearing in the Elderly: Aging and Degeneration - Integration through Immediate Intervention" (2008–2011) (FP7, contract No.HEALTH-F2-2008-200835)."

FP-030

Hearing Screening in 6th grade children in primary schools in Warsaw

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Introduction: Hearing disorders disturb the child's reception of sound, as well as the development of speech which in consequence negatively affects the child's relations in society. The early detection of hearing impairments in children enables the effective implementation of medical and rehabilitation procedures or preventive treatment. These lead to lessening or eliminating various kinds of communicational disorders and dysfunctions in this way creating equal opportunities for personal and social development.
Aim: The assessment of hearing in the population of twelve-year-olds – 6th grade pupils in primary schools in Warsaw.
Material and Methods: Hearing screening (HS) was conducted in a group of 27758 6th grade pupils in primary schools in Warsaw (years 2008–2010). HS was performed on the basis of the audiometric procedure of measuring the hearing threshold and a Dichotic Digit Test (DDT), used to assess the auditory processing. Positive result of HS was defined as equal or more than 25 dB at least at one frequency in either ear and less than 70% and 50% of DDT in right and left ear respectively. Additionally subjective assessment was carried out on the basis of child's and parents' questionnaire.
Results: Positive results of HS obtained in 19.8% in total, for pure tone and/or DDT.
Conclusions: The obtained results confirm the significant prevalence of hearing problems in school aged children. Based on the results the implementation of HS as a routine procedure in the medical care in schools is strongly recommended.

FP-031

Hearing screening in Hungary

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Background: In Hungary audiology is based on the medical profession. An audiologist must be first an ENT specialist. After two more years he/she can pass the examination of the subspecialization: audiology. Audiological assisstants must attend a special school for 5 semesters after „matura". In the near future this system will be changed.
In the Hungarian ENT Head and Neck Surgery Society there is the „Section of Audiology" which has the responsibility for the hearing situation of the country.
Methods: There is a universal hearing screening program in Hungary with different methods. The most suitable according

to the Hungarian Collegium of Otolaryngology and Audiology is OAE for newborns and small babies. There is also screening at the day care centers at the kindergartens and for children before going to school. The screening at primary schools is sporadic. The impact of noise is emphasized but there is no universal screening concerning noise damage in the young people.
Results and Conclusions: For the future a simultan hearing vision and speech program would be necessary in school age children. At present vision program is for children just before going to school. There is a tendency and a plan that vision should be checked at 1–3–5 years of age.
SNHL is in 0.05–0.2 percentage in the newborns. At about 5–10% of the schol age children need treatment for conductive and SNHL. The speech of the children is checked by the logopedists and speech therapists at the kindergartens. Tinnitus is a significant problem mainly in the elderly people.

FP-032

Central auditory processing abilities in patients with different language disorders

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Background: A relationship between auditory processing disorders and language disorders has been suggested by previous researchers. However, using the most state of the art radiographic technologies, i.e. MRI, no definitive answer has been given in relative to this question.
Aims: The purpose of this study was to investigate central auditory processing abilities in individuals classified with language disorders such as, stuttering, asphyxia, dyslexia and SLI.
Method: This study was analytic cross-sectional, Four groups of individuals with different language disorders such as stuttering, asphyxia, dyslexia and SLI and one group of normal cases enrolled in this study. Fifteen male patients in each group with the age range of 11 to 15 years (average age 13.25) were evaluated. SSI, MLD, SSW, CST, Gap detection and Wepman auditory discrimination tests were performed. The results were compared among groups.
Result: According to our findings, there were significant differences among groups with different language disorder by different tests. However, the different was not significant in some tests such as MLD and SSI-CCM.
Conclusions: Our results indicate the relationship between language disorders and central auditory processing disorder. The difficulties with gap detection observed in the groups suggest the existence of fundamental problems in processing the temporal form or microstructure of sounds characterized by rapidly changing onset dynamics. Children with different language disorders have different auditory processing deficit – not only integration, but also associative deficit, deficiency in the ability to perform tasks that require interhemispheric communication and inefficient intrahemispheric cooperation.

FP-033

Low intensity phonological training by means of a computer based program: behavioral and neurophysiological findings from hearing impaired and normally hearing children

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In the present study children with cochlear implants and/or hearing aids and normal hearing children between 5–7 years of age received computerized phonological training 10 minutes per day during 4 weeks. All children were in the normal range of non verbal ability. The aim was to study whether phoneme-grapheme training on various linguistic levels affected their neurophysiological and cognitive development and how this was related to different aspects of reading ability. The design was A-A-B-A. Behavioral tests measuring different aspects of phonology and letter knowledge were administered at baseline 1, 2 and post intervention. Working memory, non verbal ability and reading as well as Event Related Potentials (ERP) including Mismatch Negativity (MMN) and N400 were measured at baseline 2 and post intervention. The results showed significant changes of decoding skills and working memory ability between baseline 2 and post intervention across all groups. ERP data were analyzed for posttraining effects and between group differences. MMNs were smaller for the hearing aid and CI groups and larger in the normal group. There were differences in amplitude of the three conditions in N400; congruent, within or between category violations. The results will be further presented and discussed with respect to the impact of phonological intervention on neurophysiological development and development of cognitive skills.

FP-034

Design and validation of an Auditory Processing Test Battery in the Netherlands

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Auditory Processing Disorders (APD), can be defined as difficulties in the processing of auditory signals that not solely result from a hearing loss, deficit in general attention, language or other cognitive processes. In practice, children with APD have difficulties with listening and learning and may have often

been diagnosed with SLI, ASS, AD(H)D or learning problems. For a proper diagnosis, a test battery in native language should be available and should be part of a multidisciplinary approach. In the Netherlands, some not fully validated tests for auditory functioning are in use, but for a nation-wide uniform approach of APD in schoolchildren, none of these assessments satisfied. Therefore a new Dutch test battery has been developed and is currently being validated for children in the age range of 4–18. In our presentation we will review the test set-up, present the contents of the test battery and show some remarkable results we found so far. We will also discuss the applicability, boundary conditions and limitations of such a test battery.

FP-035

A test battery to assess peripheral and central auditory dysfunction induced by solvent exposure

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Animal studies have extensively demonstrated that solvents damage the hair cells in the cochlea. Also, human studies have shown that solvents may induce central auditory dysfunction. However, there is still limited understanding on which tests should be used to assess the auditory system in solvent-exposed individuals. The aim of the present study was to determine the most sensitive tests to detect adverse peripheral and central auditory effects induced by solvent exposure. Seventy workers exposed to different mixtures of solvents and 70 age-and gender matched control subjects were selected. Both groups of subjects were not exposed to noise levels above 85 dBA TWA. All subjects presented with normal middle-ear function, absence of a conductive component in the audiogram and no history of medical conditions relating to the onset of auditory dysfunction. All selected subjects were assessed with a comprehensive audiological test battery. This test battery was comprised of pure-tone audiometry (PTA), tympanometry, transient evoked otoacoustic emissions (TEOAE), distortion product otoacoustic emissions (DPOAE), auditory brainstem response (ABR), hearing-in-noise test (HINT), masking level difference (MLD), dichotic digits (DD), pitch pattern sequence (PPS), and adaptive tests of temporal resolution (ATTR). Solvent-exposed subjects presented with worse results in comparison to non-exposed subjects for most of the test results. Bivariate and multivariate linear regression model analyses were performed. One model for each auditory outcome (PTA, TEOAE, DPOAE, ABR, HINT, DD, PPS, MLD, and ATTR) was independently constructed. For most of the models solvent exposure was significantly associated with the auditory outcome. Also, for DD solvent-exposed subjects showed a larger left-ear disadvantage in comparison to non-exposed subjects. A discussion of these findings emphasising the tests that appear to be most sensitive to detect adverse peripheral and central auditory effects induced by solvent exposure is addressed.

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FP-036

Normative data of polish adaptive speech-in-noise and polish dichotic digit test

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Auditory Processing Disorders [APD] refers to difficulties in the perceptual processing of auditory information in the CNS as demonstrated by poor performance in one or more of auditory processing skills; such as, sound localization and lateralization, auditory discrimination, auditory pattern recognition, temporal aspects of audition, auditory performance decrements with competing acoustic signals, and auditory performance decrements with degraded acoustic signals. APD test batteries should generally include both nonverbal and verbal stimuli in an attempt to examine different levels of auditory processing within the auditory nervous system. Dichotic tests and speech-in-noise tests are two of the most widely used central auditory tests. These tests can be conducted in children at and above the age of seven years given the monitoring of the child's attention and fatigue factors which are necessary in order to obtain valid APD test results. In our procedure monitoring of attention is possible due to the unique ability to visualize accuracy and attention of the responses during the actual testing of our adaptive procedures used throughout testing.

The aim of the study was to collect normative data and test the clinical usefulness of our computerized Polish dichotic digits test and the adaptive speech in noise test.

Participants consisted of 370 normal hearing children ranging in age for 6 to 12 years of age obtained from elementary schools in Warsaw (170 children for the speech-in-noise test and 200 children for polish dichotic digit test).

Results: The normative data of both tests results are presented and the 95th percentile confidence interval was calculated to establish the limits of normal responses.

Conclusions: We developed the adaptive polish speech-in-noise test and the polish version of dichotic the digits tests successfully for use in children ranging in age from 6 to 12 years of age. These tests are part of the Auditory Processing Disorder diagnostic computer platform and can be used both as a screening tool and as a part of a diagnostic battery.

FP-037

Effect of sensorineural hearing loss on the time-compressed speech test

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The comprehension of spoken language is based on thne analysis of complex acoustic signals by the Central Auditory System. Cognitive declines and deficits in speech understanding are seen in aging individuals and also in the hearing impaired. The Time-Compressed Speech Test is a low redundancy Central Auditory Processing Test that evaluates the closure ability to recognize degraded acoustic speech words or sentences. In this work we evaluated the difficulties in understanding compressed speech. Younger and older listener with normal hearing and with hearing loss participated in the experiments. Stimulus were speech words that were unmodified in duration or were time compressed and presented at 35 dB SL. The results showed that the group of eldery listeners performed worse than younger listeners. Compressed words were more poorly perceived in listeners with hearing loss, compared to the normal group. However, when pure-tone audiometric thresholds were used as a covariate variable, the significant differences between groups disappeared. These results support the hypothesis that sensory decline in elderly listeners seems to be an important factor in explaning the decrease in speech processing.

FP-038

The outcome of cochlear implantation in children with autism spectrum disorder

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Background: The universal neonatal hearing screening is a prerequisite for early diagnosis and treatment of congenital deafness. It is in relationship with the fall of age at the diagnosis of hearing loss. In a substantial number of cases early childhood deafness is not isolated but has associated handicaps.
Aim: The purpose of this study was to evaluate the outcome of cochlear implantation in prelingually deaf children with autism spectrum disorder.
Results: Five preschool children with prelingual deafness who underwent implantation in a tertiary reference centre in the period of March 1996 till January 2011 were included. The mean age at cochlear implantation was 2.4 years. There is one who reached education in regular school system, two are educated at schools for the deaf and two are in special settings. We report detailed findings of development of these children.
Conclusions: Cochlear implant candidacy requires a team approach involving several specialists to clarify the diagnosis. Up to one in 25 children with hearing impairment may have autism spectrum disorder. With neonatal hearing screening, these children are implanted prior to autism diagnosis.

FP-039

Variability in the electrical coupling parameters of CI users

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Background: A cochlear implant encodes the sound content as a series of electrical pulses that vary in terms of three fundamental dimensions: intensity, site of and time of stimulation. For optimal hearing performance as much information as possible should be sent across the electrode-neural interface. This is important in order to reliable encode complex signals such as speech in noise, music or bilateral hearing cues. However every ear is different in terms of its response to a cochlear implant (CI) stimulus. Knowing the strong and weak aspects in the electrical coupling between the CI electrode and the auditory nerve can be of benefit during the fitting of a CI prosthesis. It is possible to measure in an objective way the peripheral neural response to changes in intensity, place and rate of the electrical stimulus. These objective measurement techniques are known as electrically evoked Compound Action Potential (eCAP). The primary aim of our study is to collect these measurements in a group of CI users and describe the variability in these measures. A secondary objective is study the correlation with speech understanding performance.
Methods: In this study nine adult subjects participated, all using an Advanced Bionics' HiRes 90K cochlear implant device. In terms of eCAP measures, the amplitude growth function, spread of excitation function and recovery function were measured on four sites along the electrode array. These measurements were correlated with speech understanding performance on speech in quiet.
Results: Significant correlations were found between tNRI and the recovery function parameters, and the slope of the amplitude growth function and the maximum eCAP-amplitude and the recovery time. Further clinical investigation is needed to describe in which way these neural parameters can help in fine tuning the fitting parameters of the cochlear implant.

FP-040

The use of pre-processing for Cochlear Implant (CI) users in difficult listening environments

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Background: Pre-processing gives the capability to program a CI Sound Processor with different programs for different listening environments. Although this technology has been available for several years, so far there are no consistent recommendations for selecting the best pre-processing strategies for each listening environment.
The goal of this study was: (1) To evaluate the performance of three different pre-processing strategies for Everyday, Noise and Focus from Cochlear under real life listening conditions; and (2) To determine if pre-processing can be successfully used in different CI Sound Processors.
Method: Ten subjects ≥18 years have been recruited for the study. The speech performance has been evaluated in acute measurements by comparing speech perception under real life conditions while using different pre-processing recommendations in addition to patient's everyday mapping. The real life conditions are simulated by presenting cafeteria-type noise @65 dB from ±70, ±135 and 180 degrees and adaptive sentences from the front. Rating scales to evaluate the perceived loudness, clarity, fullness and overall impression will be used.
Results: Preliminary results indicate that depending on the pre-processing configuration an SNR improvement of up to 6 dB can be achieved. The right combination of pre-processing strategies can significantly improve subjective performance in background noise. Further results will be presented at the conference.

FP-041

Outcomes of the clearvoicetm strategy use in children

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Background: The ability to hear in many real-world listening situations remains a challenge for cochlear implant users. ClearVoice™ has been designed to improve speech understanding in difficult listening environments without compromising performance in quiet situations. The basic principle of this new algorithm is to reduce the stationary noise and emphasize the dynamic channels containing more speech.
Aims: The aims of the study are to evaluate the benefits of ClearVoice in children and define clinical recommendations for its routine use.
Methods: Children between six and fourteen years of age using the HiRes 120™sound coding strategy for at least one year are asked to randomly test two settings of ClearVoice ("medium" and "high") during one month each. The baseline program, HiRes 120, and both ClearVoice programs are then evaluated with a sentence test in quiet and noise. Parents and teachers are asked to complete a questionnaire related to everyday noisy situations.
Results: 10 subjects will be included. The study design will be presented as well as the data obtained so far.
Conclusions: This study will complement the results from a previous study showing that most children get benefit in using ClearVoice in their daily life.

FP-042

Speech outcomes in bilaterally implanted children

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Aim: The aim is to assess benefit in speech perception in bilaterally implanted children.
Material and Method: 25 children with at least one year experience with two implants were examined with the Adaptive Auditory Speech Test. The test was performed in quiet and in noise in monaural and binaural conditions. The words were presented in free field in front of the patient.
Results: The difference between first and second implanted ear is not statistically significant for both quiet and noise. The difference between one implant and two implants is statistically significant for first implanted ear as well as for second ear when compared to both ears with $p<0.05$.
Conclusions: Significant speech discrimination improvement in bilateral conditions compared to unilateral conditions was observed.

FP-043

Speech processor upgrade in Hungary

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Nowadays the speech processor upgrade is very important. Recently there was several cochlear implant users who could be upgraded to FREEDOM and OPUS 2 speech processors in Szeged

Cochlear Implant Center. Our aim was to compare their hearing performance with the old and new devices.
Our examinations were performed in 100 patients with Nucleus and MED-EL cochlear implants. Pure-tone audiometry speech recognition tests and subjective experiences were examined.
Our results show that the pure-tone thershold and speech recognition was usually better using the new devices just after MAP conversion and optimalisation. Most of the patients prefered the new processor and only some patients prefered the old one. In addition to aesthetic benifit most of the patients had better hearing performance in quiet and noisy environment using the new procossor, but sometimes it is difficult to accomodate the new sounding.

FP-044

High-frequency deafness and hybrid CI – also in children

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Background: Fitting hearing aids in patients with high-frequency deafness is not effective. Because of the introduction of atraumatic electrodes and atraumatic surgical techniques it is possible to safe intracochlear structures. This is demonstrated by the audiological results and the use of the acoustic component within the Hybrid-CI implanted ear.
Methods: Up to the beginning of 2011 we implanted 12 children with high-frequency deafness in the age between 18 months up to 18 years of age. This was performed only in patients with audiologicaly prooven low-frequency hearing.
Results: Postoperatively in 95% of the cases the residual hearing could be saved also after another 12 months. Speech understanding in noise could be improved especially in the older children. The auditive development of the younger children is comparable to the profound deaf children with conventional CI implanted children.
Conclusions: The method of electro-acoustic implantation opens Cochlear Implantation for new indications and for perspectives to future technologies (esp. hair cell regeneration).

FP-045

Improved speech perception and sound quality in Partial Deafness Treatment with the DUET 2

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Background: Partial Deafness Treatment or electric acoustic stimulation (EAS) is a treatment of patients with a severe high frequency hearing loss. A new audioprocessor, DUET 2, has recently been released for these patients.
Aims: To evaluate the DUET 2 audioprocessor for speech perception, sound quality and users satisfaction.
Methods: 8 experienced EAS patients were upgraded from the DUET to the DUET 2 audioprocessor. Speech perception in quiet and noise and sound quality for speech and music were assessed with both devices up to 6 months after switch-over.
Results: Adaptive speech testing showed a significant improvement of 4.3 dB (p=0.035) in quiet and 6.3 dB (p=0.001) in noise with the DUET 2 compared to the DUET after 6 months. Fixed level speech perception with the DUET 2 significantly improved with 17.1% (p=0.031) in noise. Also sound quality of music and speech with the DUET 2 rated significantly better than the DUET. Patients were satisfied with the new audioprocessor, particularly in terms of enhanced sound quality, light weight and remote control with the DUET 2.
Conclusions: With the DUET 2 speech perception in noise improved significantly. Subjectively the DUET 2 was also clearly preferred by the users over de DUET.

FP-046

The atraumatic round window deep insertion of MED-EL cochlear implants electrodes in Partial Deafness Treatment (PDT) – hearing preservation and speech results

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Aim: The aim of the study was to investigate hearing preservation and speech benefit after the round window deep insertion of cochlear electrodes of MED-EL standard or FLEXsoft arrays.
Material and Methods: Hearing preservation and speech discrimination was evaluated in 42 subjects with low frequency hearing prior to surgery with 28 mm round window deep insertion of MED-EL standard or FLEXsoft electrode arrays suspected of progressive hearing loss.

Results: The ipsilateral implanted ear and the contralateral ear showed significant differences between preoperative and postoperative hearing thresholds (P<.005). When the subtraction factor of the mean contralateral hearing loss for each tested frequency for the same time interval were applied to the implanted ear, no significant hearing loss was found, showing that postoperative ipsilateral progressive hearing loss was caused by etiology rather than surgery. The mean improvement of monosyllable test scores 13 months after the hearing preservation CI surgery was 38.8% for testing in quiet and 44.4% for testing in noise.
Conclusions: The treatment of partial deafness with 28 mm deep insertion round window hearing preservation surgery is beneficial in subjects with various degrees of hearing, including patients with progressive sensorineural hearing loss.

FP-047

European multi-centre trial of the Nucleus™ Hybrid-L cochlear implant

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Background: Many candidates for cochlear implantation have significant low-frequency residual hearing. "Hybrid" or "electro-acoustic" stimulation has been proposed which allows the combined benefits of electric and acoustic stimulation in the implanted ear. A pre-requisite for Hybrid stimulation is preservation of low-frequency hearing after implantation.
Methods: 65 adult patients severely-to-profoundly hearing impaired patients with a range of low-frequency hearing were implanted with the Nucleus 24 Hybrid-L cochlear implant. Pure-tone audiometry was measured pre-operatively and at 1, 3, 6 and 12 months post-operatively. Speech recognition was measured in quiet and in noise with hearing aids and with the Freedom Hybrid processor.
Results: 89% of patients retained low-frequency thresholds within 30 dB of pre-operative levels immediately post-operatively. The median pre- to post-operative difference was 5–10 dB for 125 to 500 Hz. At 12 months post-operatively 74% of patients retained low-frequency thresholds within 30 dB of pre-op levels with a median pre- to post-operative difference of 15 dB (125–500 Hz) . A large proportion of patients performed significantly better in quiet (80% >10%age point increase) and in noise (85%, >2 dB SNR or >10%age point increase) on speech recognition tests at 12 months post-op compared to pre-operatively.
Conclusions: The Nucleus Hybrid-L cochlear implant when combined with good surgical technique provided a high level and high probability of hearing preservation. The majority of patients obtained substantial speech recognition benefit.

FP-048

Results of partial deaffness treatment with cochlear implantation with nucleus SRA electrode

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Backgound: Partial deafness is a hearing impairment where patients present profound sensori-neural hearing loss within high and mid frequencies. This results with considerable decrease of speech perception level and multiple difficulties in everyday communication. As even high power hearing aids very often do not provide sufficient amplification, these patients finally became non-users.
The aim of this study was to evaluate a benefit of Partial Deafness Treatment in terms of preservation of residual hearing and restoration of speech perception with cochlear implantation with Nucleus SRA electrode. Outcomes were evaluated in a group of children and adults by comparison of pre- to postoperative results of tonal audiometry and speech perception in speech audiometry in adults and auditory adaptive speech test (AAST) in children in quiet and in noise.
Material and Method: 63 patients (35 adults and 28 children) with bilateral partial deafness of duration no longer than 30 years were qualified for cochlear implantation and implanted with Cochlear SRA electrode with round window approach. Speech audiometry and auditory adaptive speech test (AAST) in best fitting conditions in both ears was assessed pre-op and at intervals according to protocol up to 24 months post implantation. Hearing threshold levels in tonal audiometry were measured over time.
Results: At 12 months post-over 95% of implanted adult subjects and at 6 months follow up 90% of implanted children had significant improvement in speech reception scores in both conditions: in noise and in quite. Out of 63 subjects only 4 lost their hearing post -op, over 75% retained hearing in the implanted ear within 10 dB of pre-op levels. Follow up showed post-op hearing thresholds to be stable over time.
Conclusions: Speech reception performance of subjects implanted with the Nucleus SRA CI was significantly improved. A round-window approach surgical technique seems to be an adequate surgical technique to achieve a high rate of hearing preservation and allow for successful speech recognition.

FP-049

Hybrid-L and CI422 for Treatment of Partial Deafness

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Objectives: Due to the dimensions and characteristics of the Nucleus Hybrid-L and the Nucleus CI422 Cochlear Implant (CI), both can be used to preserve residual hearing. The main difference of both implants is the length of the active electrode array. The goal of this study was to determine whether a longer electrode offers the same amount of hearing preservation while allowing electro-acoustical as well as electrical only stimulation without compromising speech performance.
Methods: Subjects with a severe to profound sensorineural hearing loss for frequencies >1500Hz and substantial residual hearing for frequencies ≤1500Hz have been implanted with a Nucleus Hybrid-L or a CI422 Implant. Twenty of the subjects have been implanted with a Hybrid-L and the remaining ones with a CI422 Implant. A single subject design with repeated measures of unaided pure tone thresholds and speech performance is used comparing electro-acoustical and electrical only stimulation.
Results: Hearing preservation (HL<30 dB) has been observed in 100 percent of the measureable cases with the Hybrid-L Implant. The hearing preservation with CI422 will be further identified throughout the study. First results indicate no significant difference in speech performance between both implants with either electro-acoustical or electrical only stimulation. Final results will be presented at the conference.
Conclusions: The results indicate that residual hearing can be preserved with the Hybrid-L and the CI422 electrode. The full flexibility of a 22 channel arrays in both implants while offering electro-acoustical and electrical only stimulation provides a substantial functional benefit with both implants. These are important foundations for Treatment of Partial Deafness.

FP-050

Transient evoked otoacoustic emission suppression and speech in noise intelligibility in migraineurs with phonophobia

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Background: Phonophobia describes sound intolerance, one of the characteristic symptoms associated with migraine attacks (Vingen et al., 1998). Hyperacusis is an abnormal sound sensitivity arising from within the auditory system, either peripheral or central (Jastreboff and Hazell 1993).
Methods: Transient evoked otoacoustic emission (TEOAE) with and without contralateral acoustic stimulation (CAS) with white noise and speech in noise intelligibility (SIN) in the interictal phase of migraine in 25 normal hearing migraineurs with ictal phonophobia, compared to 25 well-matched subjects.
Objective: to assess the function of the cochlear outer hair cells (OHC) and their efferent regulation by the medial olivocochlear bundle.
Results: Migraineurs showed statistically significant lower TEOAE than controls in the higher frequency bands as well as in overall response, overall reproducibility and mean AB value reflecting OHC dysfunction. But the majority of cases (18/25) showed pass TEOAE and only 7/25 showed partial pass bilaterally. After CAS, migraineurs showed statistically non-significant weaker TEOAE suppression than controls. Around 60% of ears had suppressed TEOAE overall response. Loudness discomfort level (LDL) was significantly lower than controls but only 3 cases showed hyperacusis, LDL and migraine duration were not correlated. TEOAE suppression was significantly correlated with word discrimination % in different signal to noise ratios (SNR) at certain frequency bands; but was not correlated with SNR of speech reception threshold in noise. TEOAE and SIN tests were not correlated with LDL or migraine duration.
Conclusions: Cochlear OHC and their efferent regulation by the medial olivocochlear bundle can get affected in about one third of migraineurs with phonophobia, but still the majority remains unaffected. This suggests other mechanisms than efferent system dysfunction causing phonophobia in migraineurs, while the affected minority may have associated sub-clinical hyperacusis that needs follow-up of their LDL for clinical diagnosis.

FP-051

Otoacoustic emissions in neonates measured in different acquisition protocol modalities

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Background: In the testing of ears using otoacoustic emissions (OAEs) most often screening protocols are used. These protocols are fast but some properties of the OAE response are lost.
Aims: The purpose of the study was to investigate transiently evoked otoacoustic emissions (TEOAEs) recorded in neonates using fast screening and longer non-linear and linear stimulation protocols.
Methods: In the non-linear protocol modality, a series of four clicks was delivered to the cochlea, with three clicks at the same level and polarity and with the fourth click being three times greater in amplitude and inverted in polarity. In the linear protocol modality all stimuli were presented at the same level and polarity. TEOAEs were also measured with the QuickScreen protocol, which records signals in a shorter 12 ms window. For each subject an average of 260 responses, per protocol, was recorded for off-line matching pursuit (MP) analyses.
Results: The MP method allowed the decomposition of the TEOAE signals into waveforms of defined frequency, latency, time span, and amplitude and also identified patterns of resonance modes, that were characteristic for the TEOAEs recorded in each individual ear.
Conclusions: The results indicate that TEOAE recording windows with reduced length (i.e. QuickScreen) can be used only in fast detection of an OAE presence. For more sophisticated clinical analyses the standard 20 ms TEOAE recording window is more appropriate.

FP-052

Study of the cochlear active mechanisms in young normal hearing subjects affected by willams syndrome: Time-frequency analysis of otoacoustic emissions

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Subjects with Williams Syndrome (WS) typically exhibit some audiological abnormalities, such as auditory hypersensitivity, mild-to-moderate sensorineural hearing loss, chronic otitis media or conductive hearing loss. Some recent studies used otoacoustic emissions (OAEs) to demonstrate that WS subjects might have possible subtle (i.e., sub-clinical) dysfunctions at the level of the cochlea, but these studies did not control for confounding factors, such as hearing sensitivity, middle ear functionality, or age. This study was the first one that measured and analysed OAEs in WS subjects with normal hearing thresholds and normal middle ear functionality, compared to an age-matched group of typically developing control subjects [further details on the protocol and subjects can be found in: Paglialonga et al., *Hear Res* 2011]. To further improve the sensitivity of OAEs to detect possible subtle dysfunctions in WS subjects, in addition to the conventional analysis of the *whole* (i.e., broad-band) OAE recordings, in this study a time-frequency analysis of OAEs was also performed and a set of narrow band *frequency components*, representing different evoked contributions to the whole OAEs, were extracted and analysed in the two groups of subjects.
We observed that both OAEs and their frequency components had significantly lower energy in WS subjects than in the controls and, also, that the latency of frequency components slightly increased in WS subjects.
Overall, results suggested a subtle (i.e., sub-clinical) dysfunction of the cochlear active mechanisms in WS subjects with otherwise normal hearing. Remarkably, results point out the relevance of using OAEs in the audiological evaluation and monitoring of WS subjects to early identify possible subtle dysfunctions, before the onset of mild or moderate hearing loss that could also lead to language or cognitive impairments.

FP-053

Interpretation of distortion product otoacoustic emissions at higher frequencies

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The healthy ear responds to an appropriate dual-tone stimulus by producing a tonal signal known as the distortion product otoacoustic emission (DPOAE). This cochlear by-product, recorded by a probe in the ear canal, allows an efficient and non-invasive objective examination of the hair cell activity, and is especially suitable to assess the frequency-specific cochlear function. While in-situ calibration provides an efficient way to adjust the stimulus levels for each individual test subject, it fails at higher frequencies due to calibration errors. With increasing frequency, the influence of standing waves within the ear canal becomes larger, rendering the DPOAE analysis difficult. In this study, we tested for the presence of DPOAEs up to a stimulus frequency of 12 kHz in ten human ears, and in a dummy head equipped with an ear simulator, using a commercial auditory diagnostic system. Measurements were carried out for two insertion depths of the probe: "deep" and "shallow" insertion. The "shallow" insertion was attained by pulling the probe from the "deep" insertion position towards the ear canal entrance by about 4 mm. Due to the expected high inter-subject variability in the DPOAE results, case studies were performed. At the spectral notches of the ear-canal receiver sensitivity frequency response, the credibility of the measured DPOAEs from the test subjects became questionable. The variation of the insertion depth of the probe led to the absence of detectable DPOAEs or yielded ambiguous DPOAE amplitudes in critical frequency regions. For some test subjects, DPOAE amplitudes varied by more than 10 dB. Moreover, at those frequencies, measurements on the dummy head ear simulator resulted in detectable distortions, which the diagnostic system mistakenly interpreted as physiological DPOAE responses. These findings shed light on the current unsatisfactory stimulus calibration at higher frequencies and its profound impact on the interpretation of DPOAEs.

FP-054

The examinations of the cochlear function in patients with type-1 diabetes mellitus

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Introduction: Our previous results showed that diabetic neuropathy may be manifested in certain dysfunctions of the central auditory pathways. BAEP parameters of patients with longstanding (>20 years) type-1 diabetes mellitus differed significantly compared with healthy controls. A significant correlation was observed between the overall autonomic score (AN) and the latencies (wave III and V) and IPL-s (I–III, I–V).
Methods: We performed DPOAE examinations in patients with type-1 diabetes mellitus (DM). 27 insulin-treated patients duration were included. Cardiovascular reflex tests were applied for assessment of autonomic neuropathy. Peripheral sensory nerve function was studied with a Neurometer (Neurotron Inc., Baltimore), using constant current sine wave transcutaneous stimulation. Our aim was to compare the DPOAE results of this patient group with controls and to look for the possible correlation between the alteration of the inner ear function and the cardiovascular autonomic and the peripheral sensory neuropathy.
Results: Analysing of absolute and relative amplitudes of DPOAE we revealed a significant difference between diabetics and healthy controls. A positive correlation was observed between the cardiovascular reflex tests and the DPOAE intensities. Evaluation of the peripheral sensory nerve function revealed negative association the current perception thresholds (CPT at 2 kHz and 250 Hz) and the DPOAE amplitudes.
Conclusions: Several parameters of autonomic and sensory neuropathy consequently worsen together with abnormalities of cochlear function. Our data support the hypothesis that diabetic neuropathy might be manifested in certain dysfunctions of the hair cell activity.

FP-055

What matching pursuit tells us about otoacoustic emissions

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Otoacoustic emissions are a widely applied test of hearing, however its generation mechanisms are still a matter of debate. The approach which brought a substantial progress in understanding

of the basis of OAE is a method of adaptive approximations by matching pursuit (MP).
The MP methods relies on the decomposition of the signal into waveforms from a very broad dictionary of functions, which are fitted to the signal adaptively by the iterative procedure. Usually Gabor functions (sine modulated Gaussians) are used as a basic functions, however lately the method was improved by introduction of asymmetric waveforms. The MP method is much more efficient in approximating the signal shape than the Fourier series (containing only sinusoids) or wavelets which describe low frequency components with poor time resolution and high frequency components with a poor frequency resolution. Fixed time-frequency structure of wavelet transform does not provide the mean for efficient description of the components. MP decomposes the signal into components characterized by the parameters of a clear meaning, namely: amplitude, frequency, time occurrence and a time span.
By means of MP it was found that the human ear does not respond to the tonal stimulation in the frequency of the stimulus, but in each ear there are excited resonant modes (characteristic for the given ear). The emissions of the frequencies closest to the frequency of stimulation have the highest amplitude. This finding supports the resonant theory of hearing, which is in contrast with a "traveling wave" approach.
From the MP decomposition the latencies of the OAE components are explicitly calculated. The information on latencies was found as important in the study of subjects exposed to noise and helped in understanding the some phenomena found in neonates. Another parameter, which is determined by MP procedure is a time span. Its distribution is bimodal, hence the components can be easily sorted into evoked – short lasting and long lasting components which can be associated with the spontaneous emissions.

FP-056

Hearing threshold estimation by means of concurrent measurement of distortion product otoacoustic emissions and auditory steady state responses

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Objective audiometric tests are needed in those children where a discrepancy between the behavioural and the real hearing threshold is expected. Suited tests are distortion product otoacoustic emissions (DPOAE) and auditory steady state responses (ASSR). Both measures have their own advantages and disadvantages. DPOAE recording time is short, but DPOAE are not present at hearing losses higher than approximately 50 dB. Also, they are not reliable at low test frequencies. In contrast, ASSR are present in a wide range of frequencies and levels. However, ASSR recording time is very long.
We developed a parameter setting and a measuring procedure for an automated binaural, concurrent DPOAE/ASSR measurement by following a simple rule: Measuring DPOAE when ever possible (at a HL <50 dB HL), measuring ASSR only when necessary (at a HL ≥50 dB HL and at low test-frequencies). Performance of the new method was evaluated in 10 normally hearing subjects and 32 cochlear hearing loss patients. Concurrent DPOAE/ASSR measurements reduce test time considerably since fast DPOAE recording were done during long lasting ASSR recordings. Additionally, binaural measurements result in a bisection of the test time. There was a close relationship between the behavioural pure-tone thresholds and the DPOAE/ASSR thresholds. Mean estimation error was 1.42 dB with a standard deviation of 10.0 dB.
The findings suggest concurrent DPOAE/ASSR measurement to be a suited means for assessing hearing loss in young children where the hearing loss can not reliably be determined when performing subjective tests. Both DPOAE and ASSR are able to assess the hearing loss frequency-specificly ant quantitatively. Thus, the method can successfully be applied in pediatric audiology in order to get more precise information on the hearing loss and with that a better basis for a more reliable hearing aid fitting.

FP-057

The influence of ovarian steroid hormones on auditory function

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There is a physiological basis for the influence of ovarian steroid hormones on auditory function. The standard assisted conception protocol alters the women's hormones dramatically, and may in theory affect the auditory system.
The aim of this study was to study the auditory function (transient evoked (TEOAE) and spontaneous (SOAE) otoacoustic emissions, and auditory brainstem responses (ABR)) in women (n=14) undergoing standard assisted conception treatment with simultaneous measurements of their oestrogen and progesterone levels at three points during their treatment:

- Session 1: Following 14 days of gonadotrophin releasing hormone (GnRH) stimulation which leads to suppression of the ovarian function and ovarian steroids levels similar to levels seen in postmenopausal women.
- Session 2: Following 10 days GnRH plus gonadotrophin stimulation which stimulate the ovaries to produce several follicles and raises oestradiol levels that can be ten times what occurs in the natural ovarian cycle.
- Session 3: 10–14 days following egg collection and progesterone treatment which raises the level of progesterone (post embryo transfer).

The oestradiol levels during the first two sessions were positively correlated with the TEOAE response (p=0.03), and the inter-session difference in TEOAE responses between session 2 and session 3 was significantly greater (p=0.04) than the inter-session difference observed between the first two sessions. The SOAE frequency shifted to a higher frequency in session 2 and to a lower frequency in session 3, which was significant (p<0.001). The SOAE frequency shift had a significant positive correlation with oestradiol levels (p=0.004) and a negative correlation with progesterone levels (p<0.001). The absolute wave latencies of the ABR were shorter in session 3 and longer in session 2, with the change being significant for the Wave V latency (p=0.03). The OAE results may suggest either excitation of the cochlea by oestrogen, or its suppression by progesterone. The longer ABR latency is consistent with the inhibitory effect of neurosteriods on ABR associated with higher levels of oestrogen.

FP-058

Noise levels, response levels, and detectability of cortical responses close to threshold

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Background: There has been considerable interest in the use of Cortical Auditory Evoked Potentials (CAEPs) as an objective electrophysiological measure in individuals with impaired auditory systems. Whether for the purposes of estimating pure tone thresholds, confirming the audibility of speech sounds, or assessing the effectiveness of the auditory processing system, it is useful to know how much above behavioural threshold a sound must be before the cortical response can reliably be detected.
Aims: To bring together data from several experiments that shows how the amplitude of cortical responses increase with level above behavioural threshold, and how the background electrophysiological noise levels vary for infants and adults with normal hearing aid sensorineural hearing loss.
Methods: Behavioural thresholds for pure tones and selected speech sounds were first determined. Stimuli were then presented at levels from 10 dB below behavioural threshold up to 30 dB above behavioural threshold. Within each stimulus and participant, noise levels were estimated based on the epoch-to-epoch variance around the mean waveforms averaged across epochs. Presence of a cortical response was tested by calculating the Hotellings t2 statistic.
Results: Response amplitude increases much more rapidly with sensation level for people with sensorineural hearing loss than for people with normal hearing. Background electrophysiological noise levels within the bandwidth 1 to 30 Hz are approximately 10 to 20 μV rms for adults and approximately 30 to 40 μV rms for infants. Response amplitudes are also greater for infants than for adults, though not by same ratio as for noise levels. For most hearing impaired adults, cortical responses based on 100 stimulus presentations are virtually always detected (with p<0.05) for sensation levels of 10 dB or greater.
Conclusions: Cortical responses for stimuli 10 dB above behavioural threshold can be automatically detected with fewer stimulus repetitions in adults than in infants, and with fewer stimulus repetitions for hearing-impaired people than for normal hearing people.

FP-059

Removing the cochlear implant artefact from cortical auditory evoked potential measurements: A pilot study

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Background: There has been considerable interest in the use of Cortical Auditory Evoked Potentials (CAEPs) as an objective electrophysiological measure in individuals with impaired auditory systems. Currently the application of CAEPs to cochlear implantees is impeded by the presence of an electrical CI artifact obscuring or impersonating the CAEP.
Aims: To identify means to reduce the artefact presence in the electroencephalogram (EEG), to analyse the effect of the remaining artefact on the automatic statistical detection currently used by HEARLab for hearing aid fitting evaluation, and to modify this detection method such that it can be applied to cochlear implantees. HEARLab is a CAEP platform developed at the National Acoustic Laboratories, and applies an objective statistical CAEP detection mechanism.
Methods: To reduce artefact presence in the EEG, a hardware modification was introduced in the form of a lowpass filter (30 Hz), integrated in the recording electrodes. To identify the characteristics of the remaining artefact, 25 adults with cochlear implants were evaluated at two different sites. Three speech sounds /m/, /g/, and /t/ were applied in free field at suprathreshold intensities. All CAEP recordings were run twice to check for reproducability. All artefacts were evaluated visually.
Results: The reproducible artefact with the longest latency was 94 ms for contralateral reference electrodes. This resulted in the modification of the automatic CAEP detection algorithm to start only from 117 ms. To verify whether the proposed solution did not affect CAEP detection sensitivity, the CAEPs of 10 hearing-impaired subjects were further analysed using this new detection method. No significant reduction in detection sensitivity was observed.
Conclusions: When combined with lowpass filtering, the automatic detection method only needs to analyse the CAEP from 117 ms on to avoid CI artifact influence completely, without loss of CAEP detection sensitivity.

FP-060

Distribution of single-sample EPs in the human auditory nerve

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Brainstem auditory evoked potentials (BAEPs) have traditionally been measured using signal averaging techniques in the time domain. BAEPs are a result of time-locked neural firing response patterns in the auditory brainstem pathway. Since the BAEP is in response to multiple samples, it is not possible to describe the distribution of auditory nerve firing patterns to single sample acoustic stimulation. The ability to describe the distribution of auditory nerve firing patterns in human auditory evoked potentials has implications in the understanding of auditory disorders affecting synaptic activity of inner hair cells and VIIIth nerve dendrites in the auditory nerve.
In this study a single sample evoked potential measuring technique is described as a method of measurement of wave I of the BAEP. Thirty young adult college students between 18 and 26 years of age were tested. A post-stimulus time histogram was constructed by collecting single samples of wave I in a stimulus-on condition (two sets of 4000 samples at 80 dB nHL), and in a stimulus-off condition (two sets of 4000 samples).
A cross correlation technique was used to obtain a correlation value at each point along the sample. The peak correlation for each sample within a condition was then displayed as a post-stimulus time histogram. A Kolmonov-Smimov statistic was used to determine differences between the stimulus-on condition and the stimulus-off condition of the post stimulus time histograms. In addition the distribution of the post-stimulus time histogram was visually compared to the time-averaged waveform.
This study has shown that it is possible to measure wave I of the human BAEP using a technique that measures single sample auditory evoked potentials. The distribution of wave I may be observed using the statistical techniques presented in this
STUDY to construct a post-stimulus time histogram. The distribution of the post-stimulus time histogram may be described as a Poisson distribution similar to that seen in animal studies of single auditory nerve fiber responses (Kiang, 1965). It is believed that this technique may provide some new insights into sensorineural hearing loss and diseases affecting auditory nerve function, especially those that appear to affect temporal synchrony such as auditory neuropathy and demyelinating diseases.

FP-061

ASSR and ABR – A comparison of thresholds in infants

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Background: Compared to ABR, ASSR is a new method of objective hearing threshold evaluation in children. There is a need for more data of comparing these methods, especially in hearing impaired infants.
Aims: We studied how methods correlated for each used stimulus, and what a threshold difference (TD) was by frequencies.
Methods: The evaluation included all infants who were referred to our audiology units, in total 61 infants (122 ears) at the age from 1 to 60 months (median 11, mean 17.9). The thresholds of ABR were evaluated by narrow band CE chirps of 500 and 1000 Hz and by CE chirp. Thresholds of multiple ASSR were evaluated by chirp stimulation on 500, 1000, 2000 and 4000 Hz. Both methods were applied in all cases in the same session.
Results: The correlations between thresholds of both methods were calculated by linear regression. TD for all stimuli of both methods were analysed as well. The number of data was different for each frequency, because some children had woken up before the test was completed. Multiple ASSR thresholds were strongly correlated with frequency specific ABR stimuli (r = 0.85, 0.92, 0.94) for 500, 1000 and 2000/4000 Hz, respectively. Mean TDs (ASSR minus ABR ± 1SD) were 8.8 (8.4), 6.7 (6.9) and 8.9 (7.9), respectively.
Conclusions: The results indicated that the multiple ASSR and frequency ABR thresholds were strongly correlated. The distribution of TD in the range of ±10 dB was 82% for 500 Hz and 90% for 1000 Hz, while distribution of TD for 2000/4000 Hz was 72% in the range of 0 to10 dB(90% in the range of 0 to 20 dB).

FP-062

Objective prediction of noise induced hearing loss by auditory steady state evoked responses

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Background: The necessity of an objective tool to predict the behavioral audiogram is essential with respect to proper auditory diagnosis, rehabilitation and medico-legal aspects. Particularly this is important in patients that can not or do not want to cooporate with the behavioral tests as may happen in patients claiming for Noise Induced Hearing Loss (NIHL).
Goals: To correlate between air conduction (AC) and bone conduction (BC) thresholds with the Auditory Steady State

Responses (ASSR) audiogram. In addition, to assesses the predictive value of ASSR in NIHL.
Methods: Pure tone audiogry, ASSRs and Otoacoustic Emissions (OAE) were recorded in 360 subjects with or without NIHL. Inter and intra subject group comparisons were made. A predicting equation in order to estimate the behavioral audiogram was developed using multiple linear regression analysis.
Results: In general, the ASSR thresholds to various frequencies were highly correlated with the behavioral audiogram, ranging between 0.6 at low frequencies to 0.8 in high frequencies. In addition, the differences between thresholds were small and did not exceed 15 dB. Not only the thresholds matched but also the configuration of the audiograms to various frequencies.
Conclusions: ASSR is a very promising tool to objectively predict hearing thresholds, particularly for NIHL. In addition, the bone conduction thresholds could also be objectively determined. The multiple linear regression equation was found to predict accurately the behavioral thresholds. ASSR may contribute to objectibe, quick and accurate diagnosis of the severity of NIHL. Combining OAE to the predicting formula may enhance the feasibility and the application of objective tools in NIHL both in low and high frequencies.

FP-063

Coping with stress, effectiveness of auditory training and satisfaction from the cochlear implant in postlingually deafened adults

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Background: Presented study focuses on the styles of coping with stress experienced by the postlingually deafened adults using cochlear implants and their association both with effectiveness of auditory training and general satisfaction from the cochlear implantation.
Aims: Question asked by the authors is whether coping style, such as active coping, helplessness, help seeking and avoidance style, used by deafened CI users are related with the efficiency of their auditory training, and also with their general level of satisfaction with using the cochlear implant.
Methods: The research was conducted in the form of the interviews with patients, based on a Questionnaire containing demographic data, such as age, sex, education, as well as the information at what age did the patients loose his/her hearing, at what age was implanted, present satisfaction with the decision about cochlear implantation and others. Polish version of Mini-COPE questionnaire (Carver, 1997) was also used, as well as the test of phonematic hearing before and after the 5-day intensive auditory training, for which only implantees with at least one year experience have been qualified.
Results: The research is now being conducted.
Conclusions: Results will enable to form practical advice concerning inclusion of such forms of psychological help for deafened adults that will allow them to better handle the process of adaptation to deafness and to maximize their benefit from the cochlear implant.

FP-064

Only one side of the story – single sided deafness

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Major functions of binaural hearing are detection/ localization of sound and speech extraction in noise. For individuals with single sided deafness (SSD) potential difficulties are to understand speech when it's coming from the deaf side, perceiving speech in noisy environments and localizing sounds. Some individuals with SSD experience problems in daily life, while others manage well. Studies with the Speech, Spatial and Quality of Hearing Scale (SSQ) inventory have shown that individuals with bilateral but asymmetric hearing loss generally are more disabled than individuals with symmetric hearing loss.
The goal of the current study was to explore self-reported disabilities of adults with SSD. A special focus was to clarify whether hearing performance differed according to gender or age, and if the performance was dependent on the affected side. It was also of interest to investigate, if gradual or sudden onset had an effect on reported performance.
124 subjects with SSD were identified in our audiometry database and invited to participate in the study. The Speech, Spatial and Qualities of Hearing Scale (SSQ) by Gatehouse Noble (2004) was sent subjects together with a form containing questions about age, gender, handedness, onset, duration and cause of hearing impairment as well as use of hearing aid(s).
98 subjects (79%) responded to the survey. Responders rated performance on the speech and spatial scales at the low end and the quality scale on the high end. Overall male responders tended to rate higher than females. Distribution of hearing thresholds in the two groups was similar. With longer SSD duration there seemed to be a tendency to rate better on the speech and quality scales. Based on further statistical analyses it will be discussed what strategies are used to overcome the perceived SSD-related hearing problems.

FP-065

Effect of carrier phrase on speech intelligibility in quiet with hearing aids

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Background: A first approach to assess the functional benefit of hearing aids is by measuring the performance-intensity curve of speech in quiet with and without hearing aids. Usually, speech materials in such tests exist of single words. Nowadays, virtually all hearing aids use signal processing, such as amplitude compression or noise reduction. Especially with words presented in isolation in quiet, this signal processing may have a marked effect on overall gain as well as on gain as a function of time. Hence, there may be a difference between speech intelligibility of isolated words in quiet and of words preceded by a carrier phrase.
Aims: The present research was conducted to assess the difference in hearing-aid processed speech between words presented in isolation and words preceded by a carrier phrase.
Methods: In a hearing-aid test box, speech materials were routed through hearing aids and the output was recorded with a 2cc coupler. Hearing aids were programmed according to manufacturer's rules, using given fixed set of hearing losses, varying in degree and configuration.
Results: Recordings were analyzed in terms of level, and the differences for isolated words and words preceded by a carrier phrase were determined.
Conclusions: Dependent on hearing aid and hearing loss configuration, differences in overall level, hence in intelligibility could be substantial. Consequences for traditional free-field aided speech audiometry in quiet will be discussed.

FP-066

The results of hearing rehab with children after implants who have multiple developmental disabilities

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Introduction: Among the individuals taking advantage of the cochlear implant there are an increasing number of patients affected by additional dysfunctions than hearing loss which impairs(effect) movement, sight or central nervous system.
We are faced with additional questions concerning the effectives of our treatment and rehab as well as anticipating the well-being of this procedure in the patient.
Aim: Analyzing the rehab results after cochlear implantation in children with earlier additional developmental problems.
Material and Methods: We have examined 20 children with implants from the age of 3 to 13 who have been diagnosed with additional dysfunctional symptoms. The group was drawn from patients with various earlier complicated symptoms who were using the cochlear implant for at least 2 years.
In this group were children with paralysis cerebral palsy, blindness and damaged central nervous system. For this tests we used a LE-Q (Little Ears Questionnaire) , audiometric tests in free field and Hearing Scale and Sound Perception MAIS (Meaningful Audition Integration Scale).
Results: Most of the children in this test group:
- systematically use a speech processor,
- in the event of a dead batteries they ask for a new battery,
- reacts for most environmental sounds,

as LE-Q indicates all children in the test group show a delayed hearing development as well as hearing experiences within their age.
However we noticed systematic progress in acquiring hearing competence.
Conclusions: Using the cochlear implant in children with multiple developmental disabilities supports broadening their listening and communication skills To achieve optimal effects it is necessary to understand the specific needs of this population and adapt therapeutic strategies in order to provide the best services and opportunities for success with a cochlear implant.

FP-067

Diagnosis and cholesteatoma management in Tizi-Ouzou Hospital Algeria

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Objectives: This report evaluates management and three years follow-up of cholesteatoma in our department
Methods: This report is a retrospective analysis of results and surgical outcomes in sixty-nine patients with cholesteatoma admitted in ENT department between March 2008 and December 2010.
Results: Seventy ears with acquired or congenital cholesteatoma underwent surgical treatment to access and completely remove the sac of cholesteatoma; one patient was operated for the two ears. Reconstruction with a composite conchal graft was performed in 99 ears as a canal wall-up technique. In 11 ears an obligatory open cavity technique was performed. Office-based endoscopic surveillance and follow-up were performed. The patients are included in three groups: the first group is represented by those whose outcome is favorable. The second group is represented by uncompleted result and the third one is the group with bad result.
Conclusions: A cholesteatoma is a pathology which remains enough difficult to manage and diagnose recidivism and complications instead the development of imaging, surgical techniques and devices. The description and the analysis of the characteristics of the third group are more interesting to study to improve our management for this pathology.

FP-069

Tympanoplasty. Principles and techniques

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There are no universally accepted opinions about the course, consequences and outcome of surgery for cholesteatoma of different age and localizations. There is also difference in attitude concerning the choice of surgical technique.

Methods: Prospective study of 374 patients with cholesteatoma was performed. They were divided in three age groups: children younger than nine years, adolescents - ten to 16 years, and adults. Cholesteatoma was classified as: attic, sinus and tensa cholesteatoma. Classical canal wall up, or wall down tympanoplasty was performed in all the cases, and reoperation was done later if needed. Anatomical and functional results were followed up regularly, and evaluated three years after the operations.

Results: During postoperative course after three years retraction of neomembrane was found in 23.8% of younger children, 27.6% of adolescents, and in 9.9% of adults. Also, residual and recurrent cholesteatoma were more than twice as frequent in children (19.0%, 20.1%, and 9.4% respectively). Reoperation was performed in 38.1% of children younger than nine, in 24.1% of children aged ten to 16, and in 9.4% of adults. In one fourth of pediatric cholesteatoma reoperations conversion to open tympanoplasty was done because of extensive disease. Retraction and recurrent disease were present in about 10% of attic and sinus cholesteatoma, and in 15.5% of tensa cholesteatoma.

Conclusions: Postoperative functional and audiological results of cholesteatoma surgery in children are comparable to adults. Retraction pockets, recurrent cholesteatoma and reoperations are twice as frequent in pediatric group. The worst anatomical and functional results are achieved in tensa cholesteatoma. The age of the patient and localization of cholesteatoma are very important factors that determine the type of surgical procedure and the results of surgery for middle ear cholesteatoma. Closed technique is better for attic and sinus cholesteatoma, while in tensa opened technique seems more appropriate.

Key Words: cholesteatoma, age, localization, tympanoplasty results

FP-070

Pediatric cholesteatoma

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Cholesteatomas in children represent a specific challenge. In contrast to the adult situation, children's bone may be softer thus being destructed more frequently than in adults. This is especially true in cases of recurrences. Thus, in contrast to adults, in the Department of Otolaryngology of the University of Tübingen I children the canal down technique is used without exception. In addition, after surgery, the posterior wall of the external auditory canal is not reconstructed to allow visual access to the opened mastoid. In selected cases, a reconstruction performed when the child has become an adult.

FP-071

Partial Deafness Treatment by using Cochlear SRA Electrode – round window surgical technique and evaluation by comparison of preservation of residual hearing and insertion depth angle

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Background: Partial deafness is hering impariment severly deteriorating quality of patients' life and level of communication. Whereas high power hearing aids often do not provide sufficient amplifcation it has become grounded to qualify these patients for cochlear implantation. It is of cruicial importance to preserve residual hearing in these group of patients. For this kind of surgery a special technique and electrode array has been proposed. The aim of the study is to evaluate results of Partial Deafness Treatment with round window approach SRA cochlear implantation by comparing postoperative results of hearing preservation with angular depth of electrode insertion. Material of the study was a group of 63 patients (35 adults and 28 children) with bilateral partial deafness treated by cochlear implantation with Cochlear SRA electrode.

As a method 6 steps round window approach cochlear implantation technique, tonal audiometry and ultra high resolution CT was applied.

Results: Depending on pre-operative hearing at 500 Hz the study group has been divided into three subgroups: EC (>50 dB), EAS (50–80 dB), ES (>80 dB). Mean angular insertion depth angle for EC and EAS patients were comparable (@365, what corresponds with 20 mm linear insertion depth), whereas angular insertion depth angle in ES group ranged from 400 to 420, which corresponds with deeper linear insertion (24 mm).

Conclusions: The results of the study show, that preservation of residual hearing and complementation of mid-and high-frequency hearing is, between other factors, dependent on insertion depth and electrode design. SRA electrode is effective tool for successful hearing preservation.

FP-072

Predictive linguistic factors in cochlear implanted children

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Objective: The purpose of this study was to examine prognostic factors of cochlear implantation and to evaluate the impact of early implantation on linguistic development in deaf children.
Study design: Retrospective study
Setting: Tertiary referral center
Patients: Seventy-four prelingually deafened children implanted before the age of 5 years
Intervention: Annual follow-up after cochlear implantation
Main Outcome Measures: Speech perception, intelligibility, expressive and receptive language scores from age 3 to 8 years were globally compared between four subgroups of children. Significant differences were further explored by intergroup comparisons. Stepwise logistic linear regression was performed using the following variables: age at implantation; duration of CI use; preoperative hearing levels; age of hearing aid fitting and age at time of the evaluation.
Results: Between group comparisons displayed significant differences according to age at implantation. Multivariate analysis demonstrated the positive impact of early implantation on receptive language. Moreover, duration of CI use and pre-operative hearing levels were statistically correlated with performance on speech perception, intelligibility, expressive and receptive language. Age of hearing aid fitting was associated with speech intelligibility.
Conclusions: Age at implantation, but also duration of CI, pre-operative hearing levels, and age of hearing aid fitting may each be useful in predicting linguistic success following cochlear implantation.
Key Words: young children, cochlear implantation, language development

FP-073

The impact of age, social and demographic features on comprehensive receptive and expressive performance in Cochlear Implant patients

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Aim: Social and demographic effects on language development in cochlear implant patients was observed.
Methods: Participants were from a retrospective study of 90 children who were prelingually implanted and had about 4 years of implant experience.Comprehensive receptive and expressive vocabulary tests were performed in these 90 patients. Also some social and demographic features like gender, implant age, parents' educational level and monthly income. etc. were observed.
Results: Both expressive and receptive language performances at 4 yeras of implant experience were significantly associated with implant age, parents' socio-economic status like educational level and monthly income.
Conclusions: The results demonstrate the importance of early implantation with early diagnose and providing better socio-economic status to parents.

FP-074

Cochlear implantation in elderly patients

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In the last years the extension of the indication of cochlear implantation could be discovered. One of theese directions was the the surgical therapy in elderly patients with hearing deafness. However the cochlear implantation require special regards in the course of patient instruction, programming and rehabilitation in this patient group.
We performed 18 cochlear implantations in patients with age above 60 years. We studied their MAP patern, hearing level, speech recignition performans and satisfaction level after implantation.
Our results show that elderly deaf patients had good hearing and speech recognition level in early postoperative period by the aid of cochlear implant. But most of them are dissatisfied with this condition. Generally the normal fitting is not sufficient in theese caseses. They demand special custom programming of the speech processor.

FP-075

Results of the clearvoicetm multicentre evaluation in adults

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Background: Cochlear implant (CI) users often achieve high levels of speech understanding when listening to well articulated speech in quiet, for presentation at a comfortable listening level, without substantial reverberation or other distortions, which are commonly encountered in real life listening environments. In such difficult situations, it is still challenging for CI users to understand speech well. ClearVoice™ has been designed to improve speech understanding in such difficult listening environments. The basic principle of this new algorithm is to reduce the stationary noise and emphasize the dynamic channels containing more speech.
Aims: The aim of this multicentre clinical evaluation is to collect user fee dBack on benefit of ClearVoice in various types of noisy situations and optimize parameter choice in the use of ClearVoice.
Methods: During a routine fitting session, adult subjects receive in addition of their usual program HiRes 120™, two ClearVoice programs (one "medium", one "high") saved in a random order on their processor. The subjects are asked to complete a questionnaire at home. A first part is dedicated to demographics information. Then, following use of the three programs for one week each they are asked to complete the Abbreviated Profile of Hearing Aid Benefit (APHAB) and additional questions. Finally, a third part of the questionnaire about program preference is completed after use of each of the three programs.
Results: To date 108 subjects were included across 19 centres. From the 37 questionnaires returned so far, more than half of the subjects preferred a ClearVoice program. The APHAB results showed a trend for better performance with ClearVoice compared to the usual program.
Conclusions: Data collection is ongoing but these preliminary results already confirm that ClearVoice is an option to improve comprehension in everyday life or in some noisy situations.

FP-076

Improved front-end processing for application in cochlear implants

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Background: Typically, improvements in cochlear implant speech processing have focused in implementation of new sound processing strategies aimed at increasing spectral or temporal information available to recipients. A more recent focus has been on development of front-end processing applications, similar to approaches being concurrently developed and applied in advanced hearing aids.
Aims: The paper summarises a number of these developments including: use of a real-time noise reduction (NR) algorithm and use of an Environmental Classifier in the Nucleus cochlear implant system.
Methods: The NR program, which estimates signal-to-noise ratio of each channel on a short-term basis and attenuates masker-dominated channels, was evaluated in fourteen cochlear implant recipients. Sentence perception in competing noise, monosyllabic word recognition in quiet and subjective ratings were obtained. The Environmental Classifier, which can automatically switch to the SmartSound™ environment option best suited to a recipient's current listening situation was evaluated in fifteen cochlear implant recipients, including bilateral CI users, bimodal CI plus hearing aid users, and unilateral CI user. Subjective data was collected via questionnaires and discussion on rating of performance.
Results: Significant improvements were found in sentence perception with competing speech-weighted noise for the NR program. Subjective preference was strongly supportive of use of the NR function. Most subjects in study 2 reported significant benefits to hearing performance and comfort through use of the Environmental Classifier.
Conclusions: Advances in front-end processing, such as noise reduction and automatic switching through use of an Environmental Classifier may provide significant clinical benefits for cochlear implant recipients.

FP-077

Requirements and evaluation of electrode designs for the paediatric population

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AIM: To quantify the explantation characteristics of cochlear implant electrodes after implantation in a 3D scala tympani model.
Material And Methods: Perimodiolar and free fitting lateral wall electrodes were inserted in a lubricated 3D scala tympani model. The electrodes were removed at a constant speed and a high resolution force transducer recorded the explantation forces.
Results: The peak explantation forces with the 360 degrees insertion perimodiolar electrodes were 7 times higher than forces recorded with free fitting deep insertion lateral wall electrodes (720 degrees, 30 mm insertion). Forces for the perimodiolar electrodes were against the modiolar wall. For the non pre shaped devices forces were fairly constant and against the lateral wall of the model.
Conclusions: The life expectancy of young children exceeds 80 years. Cochlear implants are warranted for 10 years, but will function much longer. However, stimulation electrodes in the young and very young deaf patients will likely have to be explanted and re-implanted more than once during their life time. Explantation forces should be minimized to avoid inner ear trauma and protect the finite neural structure.

FP-078

ESRT, ART and MCL correlations in experienced paediatric cochlear implant users

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Introduction: The use of electrically evoked stapedius reflex thresholds (eSRT) and electrically evoked compound action potential (eCAP) threshold have been suggested as a useful means for creating a cochlear implant speech processor programme. This study assessed the viability of using eSRT and eCAP thresholds to create speech processor programmes in children with Medel Opus II speech processor.
Methods: Fourteen children and 16 adults implanted with Medel Pulsar system with Opus II speech processor participated in the study. Firstly, in the adult group, the most comfortable levels were set on all the active electrodes. Then eSR measurements were obtained on all the active electrodes, and ART or eCAP threshold measurements were obtained on the representative basal, medial, and apical electrodes (electrodes 2, 6, and 11). Measurements were performed on active electrodes only if they had been stimulated for more than 3 months. In children group procedure was similar except measuring MCL values.
Results: The eSR thresholds and the ART thresholds were obtained successfully for every participant, and MCLs were obtained for all the adult subjects. eSRT vs MCL shows better correlation for apical, medial or basal electrode than ART vs. MCL for adults population. There is no significant difference in means for ART and eSRT obtained for children and adults for apical, medial or basal electrodes.
Conclusions: Electrically evoked compound action potential thresholds and eSR thresholds, recorded in units of charge on experienced Med-El Pulsar cochlear implant adults, have been correlated with MCL values obtained using apical, medial and basal electrodes. There were no statistically significant differences in eSR and ART thresholds between adults and children.

FP-079

Clinical application of a new testing system for the fitting of CI speech processors based on the electrically elicited stapedius reflex

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Background: Fitting of cochlear implants (CI) based on objective methods is a growing field of interest as children are often implanted already at a very young age (below the age of 2). Generally children do not directly respond to electrical stimulation via CI due to a lack of hearing experience. In particular, adequate setting of comfort levels (maximum comfortable levels, c-levels, m-levels) is a difficult task. It has been known for quite some years that there exists a high correlation between electrically elicited stapedius reflex threshold (ESRT) determined postoperatively and psychoacoustic comfort levels.
Aim: As adequate instrumentation for ESRT measurements is not generally available, a new testing system with minimum hardware effort was developed which should be used in parallel to the standard CI fitting procedure.
Method: The new testing system is a digital implementation of an acoustic impedance meter for reflex detection with fast response time and sampling synchronized to the stimulation of the implant. The main hardware component is based on an external sound card which is connected to a commercial ear probe and a battery driven preamplifier. The software allows a continuous monitoring of the acoustic impedance with real time graphics during the fitting procedure of the CI speech processor. The clinical applicability of the new system was investigated.
Result: First tests in clinical routine procedures showed that real stapedius reflexes can be easily distinguished from artefacts due to the fast response of the system. For an accurate

determination of ESRT values the impedance records should be stored and evaluated offline. For the safe application of the testing system the status of the middle ear has to be checked before starting the test.
Conclusions: The newly developed stapedius reflex testing device is particularly useful when fitting of CI speech processors based on objective methods is required.

FP-080

Experimental audiology: How to avoid errors in experimental set-ups

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Animal experimentation is needed also in audiology science. To avoid animal usage as much as possible or to decrease the number of animals required should be considered before beginning of an experiment. Using clinical equipment and devices are common in animal experiments in audiology. However, the human setup of those devices, methods or environment may not be proper for the laboratory animal used. To avoid these errors in testing (i.e. during hearing measurements), several test parameters should be re-adjusted. The present author will give some information on such adjustments to decrease errors in the experiments and to avoid unnecessary animal consumption.

FP-081

Algorithm of molecular investigations among patients with hearing loss reported in the Institute of Physiology and Pathology of Hearing

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Background: In European countries, about 2/1000 children suffer from severe congenital or prelingually hearing loss, another 1/300 children are born with a minor degree of hearing loss. Causes of hearing loss are complex and in most cases harbor a combination of genetic and environmental factors. It is assumed that approximately 60% of isolated cases of hearing loss are genetic. For this type of hearing loss most often are responsible mutations in GJB2 and GJB6 genes. The optimal diagnostic algorithm for this group of patients can reduce the cost of conducting effective research and genetic counseling.
Aims: The aim of the study was to present an algorithm of molecular investigations in patients with a suspicion of a genetic based hearing loss.
Materials: 6882 DNA samples retrieved from patients suffering from bilateral hearing loss prelingual and postlingual, varying in degree from mild to severe. Only non consanguineous patients (probands) were included for the analysis.
Methods: Mutliplex PCR test for 5 common Polish GJB2 mutations, direct sequencing of coding exon of GJB2 gene, rtPCR test for the presence of IVS1+1G>A mutation, AS-PCR for the detection of GJB6 D13S1830 deletion, real time PCR for the detection of MELAS 3243 A>G mutation.
Results: Molecular analysis, performed step by step, revealed presence of the two pathogenic mutations in a group of 720 among 4103 analyzed probands.
Conclusions: Application of the optimal algorithm of molecular tests can detect the cause of hearing impairment in about 18% of patients.

FP-082

Connexin 26 related nonsyndromal hearing loss in Russia

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The etiology of hearing loss is extremely complex. In the past it has become a practice that in case of sporadic deafness with unknown etiology or with different acquired factors specialists made a choice in favour of acquired reasons. Today the situation has changed because early hearing screening reveals more cases with unknown etiology. Laboratory tests in most cases support the diagnosis of hereditary deafness which changes the doctor's position towards the etiology.
One of the most frequent forms of congenital nonsyndromal hearing impairment is the form connected with mutations in the GJB2 gene. The c.35delG mutation is the reason of the congenital and prelingual bilateral hearing loss in 50% of nonsyndromal cases. Frequency of c.35delG mutation carriers in healthy population corresponds to 2–4% in the majority of Russian regions. We have studied 623 unrelated individuals with congenital nonsyndromal sensorineural hearing loss. Most of them were sporadic. We have found out 333 patients with c.35delG mutation (53%) and 15 carriers with another GJB2 mutations. Among them 245 homozygotes (39%) and 88 heterozygotes (14%) were detected. The majority of cases (80%) had profound or severe hearing loss. Mild to moderate hearing impairment was found in about 70 individuals including relatives. We found out ten deaf children with c.35delG homozygous genotype who had one parent with normal hearing and another parent with moderate hearing loss. Healthy parent carried one 35delG mutation when affected parent had biallelic GJB2 mutations. Two unrelated families had two deaf cousins with c.35delG homozygous genotype. All described cases underline high prevalence of 35delG mutation

in healthy population, which it is necessary to consider at the genetic counseling.
The prevalence of GJB2 mutations is high both in recessive and sporadic cases. Combined neonatal hearing and molecular genetic screening will create a basis for effective prediction of congenital hearing disorders.

FP-083

Auditory sensation by soft tissue conduction without skull bone vibration

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Background: A new mode of auditory stimulation has been demonstrated: a standard clinical bone vibrator applied to skin over soft tissue sites on the head and neck induces auditory sensation which can interact with AC with BC (mastoid) stimulation, producing mutual masking, same pitch sensation, beats mutual cancellation. Aims: In order to confirm that this new mode involves only soft tissue stimulation (STC), the present study was designed to determine whether soft tissue can transmit auditory frequency vibrations along a distance, from the site over soft tissue, without involving skull bone vibrations.
Methods:
- Results Experiment 1: BC stimuli were delivered using a B-71 bone vibrator to the biceps; to the sterno-cleido-mastoid (SCM) muscles. The vibrations induced were recorded at some distance along the muscle with a sensitive microphone amplifier (PKT PRO1-0). There was a phase difference between the stimulating recorded tones which was altered while contracting, stretching; relaxing the muscle.
- Results Experiment 2: the probe tube microphone (PKT PRO1-0) was used to record sound in the occluded external auditory meatus. A sound was successfully recorded when stimulating the subjects with pure tones at bony sites (mastoid forehead), but not when stimulating STC sites (eye under the earlobe SCM muscle).

Conclusions: Muscle (a soft tissue) can convey auditory frequency vibrations along its length that BC auditory stimulation at bony sites (mastoid, forehead) elicits auditory frequency sound which can be picked up by a microphone in an occluded external auditory meatus. However, no sound can be recorded in the occluded external auditory meatus when the auditory frequency vibrations are delivered to soft tissue sites, even though the subject reported hearing the sound.

FP-084

A proteomic's approach in diagnosis of Ménière Disease

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Ménière's disease (MD) is a disorder of the inner ear characterized by an insidious onset and aspecific symptoms, such as dizziness, vertigo, tinnitus, and hearing loss, that may become very debilitating. The presence of endolymphatic hydrops is a common feature in MD patients, but the pathophysiology is still largely unknown. In this study, we have used a proteomics-driven approach to identify potential biomarkers of MD. To this end, plasma was obtained from whole blood of 16 individuals previously diagnosed as suffering from MD and compared to plasma from healthy donors. A depletion of the highly abundant proteins (i.e. albumin, IgG, transferrin, etc.) was performed in order to enhance the chance of detection of the less represented ones, therefore reducing the noise-background. Two-dimensional gel electrophoresis, followed by in-gel tryptic digestion of the selected spots and LC-MS/MS analysis, allowed us to identify a set of proteins whose expression appears to be differentially modulated in patients vs. controls. In particular: complement factor H and B, fibrinogen alpha and gamma chains, beta-actin and pigment epithelium derived factor are over expressed; on the other hand, the levels of beta-2 glycoprotein-1, vitamin D binding protein and apolipoprotein-1 are significantly decreased in the plasma of MD-affected individuals. Even though preliminary and not necessarily linked directly to the molecular pathogenesis of the disease, our original findings suggest that a molecular signature, represented by the plasma protein profile previously described, might represent a potentially powerful, innovative and not invasive tool for early diagnosis and clinical management of MD patients.

FP-086

Conductive hearing loss of inner ear origin: Animal model and clinical studies

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Background: Air bone gap (ABG) is frequently associated with inner ear anomalies, mainly of the vestibular organ. This ABG exists in spite of normal external and middle ears.

Aim: To study the effects of experimental bony fenestrations in the cochlear cavities and vestibular apparatus on air and bone conduction hearing thresholds of rats. In addition, the ABG in patients with hearing loss but with normal middle ear fundtions were also examined.

Method: Bony fenestrations without damaging the mebranous labyrinth were performed on scala vestibuli, scala tympani, lateral, posterior and superior semicircular canals of 40 fat sand rats. ABG was tested 47 patients suffering from severe to profound hearing loss and having normal middle ears. In animals, hearing was tested using ABR by air and bone conduction stimuli at low and high frequencies.

Results: Bony fenestartion on cochlear or vestibular parts of inner ear induced ABG that recahed up to 60 dB ABG, both in high and low frequencies. The location largely affected the size of the ABG. In patients, the ABG was largest in low frequencies and bigger in patients with abnormal CT scans.

Conclusions: We suggest that ABG both in animals and patients was induced because of depletion of air conduction acoustic energy coming from stapes motion, while the reaction of the otic capsule to BC stimuli did not change and in some cases, even improved. These results have implications to diagnosis, treatment and rehabilitation and to basic understanding of hearing mechanism.

FP-087

Biological and clinical applications audiometry

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Audiometry, along with other instrumental clinical methods (tympanometry, otoacoustic emission) allows us to refine diagnosis of many hearing dysfunction. Improving the evidence-based medicine, including the establishment of functional relations between the sound parameters (sound frequency and pressure level) and characteristics of auditory sensation (tones height and loudness) opens new possibilities of audiometry.

On the basis of many classic experiments (G.Bekesy, 1960; H.F.Schuknecht, 1974) the author has developed an acoustic-wave hearing model It establishes conformity between the frequency of the sound stimulus f and coordinate auditory receptor x(f) and is expressed by $x(f)=L_o(1-2^{2\log(f/fmo)})$, where L_o=32 mm – length of a standard basilar membrane, f_{mo}=20 kHz – maximal sound frequency for human ear. Biophysical interpretation of the acoustic-wave hearing model, explaining the many hearing manifestations, makes it possible to solve the general theoretical and practical problems in biology and medicine. Some parameters of the inner ear can be calculated using the method.

Audiometric determination of an upper (maximal) sound frequency fm, which patient hears, we can calculate the real length of the basilar membrane and the cochlear duct $L_r=x(f_m)=L_o(1-2^{2\log(fm/fmo)})$ and compare it with the standard Lo, both in absolute and in relative significance.

Audiometric measurement of the lowest (minimal) sound frequency fa, gives the width of the apical ligament of membranes of the cochlear duct $L_a=x(f_a)=L_o(1-2^{2\log(fa/fmo)})$ and compare it with the standard equal to $L_{a,s}$=0.5 mm at $f_{a,s}$=20 Hz.

The difference between the obtained values corresponds to the functional length of the basilar membrane.

The last relation can be used as a model for measuring the defect of cochlear duct (basilar membrane) are not able to perceive sound frequencies $\Delta f_d=f_{d1}\div f_{d2}$.

This increases not only informative use of the model, but based on this method of calculating the amount of non-invasive biological parameters of the structures of the inner ear of man. But for these goals, industrial audiometers should be improved to use arbitrary sound frequencies.

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FP-088

Perception of a prosodic pattern in background noise

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The perception of speech in the presenof interfering noise remains an important issue in the field of audiology. Successful perception of speech under adverse listening conditions is facilitated to a large extent by the redundancy of the speech signal. An important cue that contributes to the redundancy of the speech signal is prosody, or suprasegmental speech features. The present study investigated the acoustic cues of a particular prosodic pattern, validated its recognition in quiet, and assessed its recognition in noise by normal-hearing listeners. The prosody under investigation was conditional permission, approval or agreement, which was marked by a forward-looking contrastive accentuation of the noun as well as cues of continuation, indicating that the utterance was unfinished. A collection of sentences were recorded from eight different speakers. Two versions of each sentence were recorded, one giving unconditional permission or approval and the other adding a condition which was subsequently removed from the digital recording to eliminate differences in content between the two versions while retaining prosodic differences. The average recognition score of a group of normal-hearing listeners (n=12) in a quiet listening condition was 88% (standard deviation=6.95%) across the different speakers, which was significantly above chance. The recognition of the prosodic contrast was evaluated in a second group of listeners (n=9) in speech-weighted noise, at three different signal-to-noise ratio's (SNRs) and compared to recognition of words and sentences at the same SNRs. Findings indicated that the recognition of sentences and of words in sentences deteriorated significantly as the SNR deteriorated, while recognition of prosody did not, remaining significantly above chance, even at an SNR of –8 dB. These findings indicate the resilience of the prosodic pattern under investigation to the effects of noise.

FP-089

Efficacy of utilizing patient self-report of auditory complaints to monitor aminoglycosides ototoxicity in a group of adults with drug-resistant TB

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Background: Tuberculosis (TB) is one of the major health concerns in South Africa. In 2005 alone, about 30 000 deaths were attributed to TB and the prospects are not getting better following the advent of drug resistance to treatment. The treatment of drug resistant TB involves the use of aminoglycosides, some of which are ototoxic. Failure to closely monitor patients taking ototoxic drugs can lead to irreversible auditory dysfunctions. Unfortunately, monitoring, early detection and prompt management of the ototoxicity in developing world are hampered by lack of technical-know-how.
Aim: The primary aim of this study was to explore the efficacy of using patients' self-reported of auditory problems to monitor ototoxicity in a group of adult patients with drug-resistant tuberculosis (TB) whose treatment regime include ototoxic medications.
Method: Fifty-three individuals, 27 females and 26 males, (mean age 33 years) with either multi-drug resistant (MDR) or extensively-drug resistant (XDR) strains of TB were recruited to take part in this study. All participants were administered a self-developed pretested/validated questionnaire for auditory complaints. The questionnaire covered: Demographic information, impairment of body functions, activity limitations and participation restrictions specific to auditory function. Participants also had audiometric assessments afterwards. Their audiometric records were also reviewed to confirm that the hearing loss was drug-induced.
Results: The findings of this study showed a poor relationship between self-reported hearing loss and audiometric hearing thresholds, especially in participants with mild to moderate (26–55 dB HL) degrees of hearing loss. There was no statistical significance between self-perceived hearing loss and participation restrictions ($p>0.05$).
Conclusion: Self-report of hearing impairment from the patient was found to be an unreliable approach for detecting auditory dysfunction in patients taking ototoxic TB medications and therefore audiometric assessment remains the gold standard.
Key Words: tuberculosis, drug-resistant, ototoxic, self-reported, hearing impairment, participation restriction

FP-090

Can a self report survey show the relationship between individual lifestyle and perception of noise tolerance?

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Objective: There is growing evidence that lifestyle factors such as music exposure, alcohol consumption, smoking, and experiential exposure to noise potentially affecting the viability of the auditory system and hence a person's auditory thresholds and ability to perceive speech in noise. This study sought to identify if a self-report questionnaire could effectively find correlations between adult perception of ability to hear and ability to understand speech in noise with reported lifestyle choices.
Study Sample: Responses of 331 females and 85 males who completed the online version of the original Experiential Tolerance for Speech in Noise Lifestyle Questionnaire (ETSN) were analyzed for possible correlations between perception of hearing loss and ability to hear in noise in relation to various lifelong lifestyle choices.
Results: Using Pearson chi-square and logistic regression analyses for the lifestyle variables, there was an indication that individuals with advanced aging, longer experience of alcohol consumption and smoking, and increase activity levels were more likely to report perceived hearing loss and increased difficulty hearing in noise. In addition, individuals who reported a decreased amount of sleep had much greater chance of reporting more difficulty hearing in noise only.
Conclusions: The self-administered and self report ETSN questionnaire can identify those lifestyle factors that result in a higher chance of an individual experiencing decreased hearing acuity and greater difficulty hearing in noise. Such a self-administered survey can be utilized to assess risks in individual's lifestyle that can ultimately result in difficulties in hearing and hearing in noise.

FP-091

Multilingual speech audiometry for Europe: Reference values and practical applications from the HearCom and HurDig project

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For many years, there have been efforts to harmonize audiological measures of speech understanding throughout Europe. Within the projects HearCom and HurDig, existing and new tests were collected and developed that allow state-of-the-art audiometric measurements while being highly comparable across different languages. There are three different speech test types in this collection: digit triplets tests for hearing screening, short meaningful sentence tests for efficient hearing diagnostics, and matrix sentence tests for repetitive in-depth measurements, e.g. for hearing instrument fitting or clinical studies.
These three types of tests are available in various languages and have been implemented on a common software platform for quick, easy, and standardized usage. An overview of the tests and of the possible applications in hearing research and in clinical practice will be given. After a summary of tests available and in preparation, the similarities and differences between the test types will be discussed with respect to their different areas of application. In addition, reference values for the standard conditions of the tests will be given for the different languages. Standard conditions include adaptive measurements in quiet and in noise and open and closed formats of the tests. Finally, typical examples will be shown of how the tests can be used for practical applications such as, e.g., demonstrating the benefit of a second hearing aid compared to a monaural hearing aid provision in background noise.

FP-092

Does the type of background noise affect speech intelligibility differently across languages? – A multilingual comparison using the Spanish, Russian and German matrix test

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Background: Even though the same construction, recording and optimization principles have been used across several languages, small speaker- or language-specific differences still exist for the matrix sentence intelligibility test which is now available in several languages. For example, the reference speech reception threshold in noise (SRT, i.e. the signal-to-noise ratio corresponding to 50% correct responses evaluated with normal-hearing native subjects in each language using the test-specific noise) differs significantly across. Ideally, by simply adjusting the SRT-values according to these reference values, any speech test result should be transferable to another language even though the languages differ considerably with respect to the information distribution across phoneme types and speech spectrum. This study therefore tests if this assumption still holds when a noise interferer is used that differs from the standard. It was also tested if any of the observed deviations can be explained with a simple speech intelligibility model like the Speech Intelligibility Index (SII).
Method: Russian, German and Spanish subjects were tested in their native language using different interferers. The SRT was determined using an adaptive procedure. The measured results were compared to predictions of the SII.
Results: Preliminary data indicate that only small differences occur between speech-shaped noises with the Spanish test while larger differences across noise types were found for the Russian

and German test. The release from masking caused by fluctuating noise with the same long-term-spectrum, however, was similar across languages.
The predictions of the SII differed from the measured data especially when the deviations of the speech spectra from the interfering noise spectrum were large. This indicates that the different way of distributing information across spectrum in the respective language is not adequately captured by the SII. It also demonstrates the potentials and limitations in comparing speech intelligibility results across languages.

FP-093

A speech-in-noise test to screen hearing ability in adults

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The*Speech Understanding in Noise* (SUN) test is a speech-in-noise test to screen adults and older adults for hearing ability. Based on the number of speech stimuli correctly identified, the tested subject gets one of three possible test outcomes: ‚no listening difficulties', ‚a hearing check would be advisable', or ‚a hearing check is recommended'. The SUN has been developed for the Italian, German, English, and French languages.
This presentation will focus on the main results obtained with the SUN test in the Italian, German, and English languages. The test was used to screen a population of more than 2500 subjects with varying degrees of audiometric thresholds and audiometric configurations in a variety test settings, both in low and in high ambient noise.
In particular, the influence of hearing sensitivity, hearing handicap, subject's age, and ambient noise on test performance will be analysed and discussed. The performance and the main features of the SUN test will be illustrated in detail, and the feasibility of using the SUN test to screen adults and older adults, either in clinical or in non clinical settings, will be discussed.

FP-094

Validation of the LittlEARS Questionnaire in Polish Cochlear Implanted children

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Background: Introduction of pediatric cochlear implantation generated an interest in new assessment measures of auditory-verbal and language abilities of young implanted children as well as in benefits of new emerging technologies. Parental questionnaires can be useful instruments for complementing professional assessments carried out before and after cochlear implantation in formal clinical contexts. One of such an instruments is the LittlEARS questionnaire developed to assess auditory behavior of infants up to two years of age.
Aim: The aim of this study is to evaluate the psychometric properties of the Polish version of the questionnaire in cochlear implanted children.
Methods: 130 children before age of two implanted between October 2007 and July 2009 in the Institute of Physiology and Pathology of Hearing were tested with the Polish version of the LittlEARS questionnaire. The questionnaire was applied at first fitting of the speech processor and at each follow up visit
Results: The mean values (difficulty indexes) of the answers to the questions at first LittlEARS application range from 0.01 to 0.62. The obtained values of corrected item-total correlations range from 0.10 to 0.73. The Cronbach's alpha coefficient value is 0.94, indicating that the answerers are highly consistent. The follow up results were also appropriate: an increasing total score didn't influence the stability of psychometric indexes.
Conclusion: The results support the use of LittlEARS questionnaire in cochlear implanted children as a sensitive and reliable tool to monitor the benefit from new device.

FP-095

Risk factors of hearing impairment in children

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Introduction: Hearing impairment is a widespread clinical and social problem, especially among children. The major problem in addressing this disability is the general lack of awareness of parents and some health professional about risk factors of hearing impairment. This shows necessity of epidemiologically-valid, population-based national surveys which based on objective diagnostic methods. Early detection and prevention of risk factors of hearing disorders are the best way of controlling burden of this disease through appropriate prevention almost 50% of cases can be prevented.
Objective: To learn the main risk factors and etiological aspects of hearing impairment in children.
Methods: According to the objective, we provided comprehensive clinic-audiological examination to 175 children aged from 1 to 7 years old. They all had various types of hearing impairment. The work was done at the out-patient unit of Otolaryngology department of Tashkent Medical Academy.
The examination included itself, initial history taking (collecting anamnesis; answering for questionnaires about risk factors, pre postnatal conditions etc.), micro-otoscopy, otoacoustic emissions, registration auditory brainstem response, auditory steady state response, acoustic reflex studies.
Results: The overall results of objective diagnostic methods showed that, in 114 children diagnosed sensorineural type of hearing loss, in 30 conductive type and in 31 mixed type.

According to anamnesis and the review of answered questionnaires, among sensorineural hearing loss children: in history 52 patients had some kind of prenatal nervous breakdown, 10 had some birth traumas, 22 had postnatal hypo-ischemic nervous breakdown, 2 had hydrocephaly. 10 patients were taken ototoxic drugs, 10 patient's parents were "kin marriage", and 8 patients were passed some kind of infectious disease.

Conclusions: Evidence based approach in hearing impairment etiologic and pathogenic diagnostics, treatment and rehabilitation measures, and implementation of new technologies and comprehensive management approaches can not only improve the quality of life for substantial number of children with hearing impairment but also makes it to prevent many possible consequences and potential new cases as well.

FP-096

Image-based and self-controlled test procedure for assessing pure-tone thresholds in children

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Conditioned play-audiometry is a well established method in pediatric audiology. However, the task (usually placing a peg in a pegboard) is varied only little and thus can result in a less reliable threshold determination. In order to enhance the child's attentiveness an image-based touch-screen controlled test procedure (MAGIC) was developed.

Different animals represent different frequencies (cow 250 Hz, bear 500 Hz, elephant 1 kHz, cat 2 kHz, sheep 3 kHz, mouse 4 kHz, bird 6 kHz, dolphin 8 kHz). Each animal was present in three variants: neutral to start the sound presentation, healthy and sick for indicating the two conditions ‚heard' and ‚not heard'. Before measurement, a story was told such that the child was instructed that healthy animals will make sounds and sick animals are not able to. The test procedure progress was visualized by a shelf from which the current test animal was selected. The test was performed in 108 children aged between 3;6–11;11 years. For comparison, play-audiometry pure-tone thresholds (PTA) were determined at the corresponding frequencies.

There was a highly significant ($p<0.001$) correlation between MAGIC and PTA thresholds. Mean and standard deviation of threshold differences amounted to –1.5 dB and 9.6 dB, respectively. MAGIC test-time per frequency was on average 30s, ranging from 14s to 91s and thus was lower than PTA test-time. By using animals as visual amplifiers and using a self-controlled measuring procedure the child's attentiveness was considerably enhanced. Thus, MAGIC may provide an alternate to the commonly used procedures.

FP-097

Muenster parental training for improving parents' communication behaviour towards their hearing-impaired toddlers and infants

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The diagnosis „hearing impairment" can inhibit the intuitive parental didactics. Parents of hearing impaired toddlers and infants tend to be too initiative in the communication and interaction with their child and also tend to be less responsive to their child's vocalizations than parents of normal-hearing children are. The Muenster Parental Training supports the language development of hearing-impaired preverbal children by training communication-enhancing behaviour in their parents. They learn to react immediately to the child's verbal and nonverbal communicative signals, to give an expanding fee dBack, and to follow the attentional lead of the child. In 15 parents (age of the children from 3 to 18 months) parent-child interactions were examined by video-analysis before and after the eight-week training-program in comparison with a control group. The parents' satisfaction with the training was investigated by a standardized questionnaire (FBB, Mattejat und Remschmidt 1998) and by a self-developed questionnaire.

In contrast to the control group we found in the trained parents a significant increase of responsive behaviour (Wilcoxon test, $p=.001$) and a significant reduction of communication-inhibiting initative behaviour (t-test, $p<.001$). The result of the questionnaires was a high satisfaction of the parents with the training (mean values 3.1 and 3.4 on a scale from 0–4). The Muenster Parental Training can be applied as an early intervention procedure after diagnosis and hearing-aid fitting to effectively enhance the communication behaviour of parents towards their hearing-impaired toddlers and infants.

FP-098

Assessment of central auditory processing in children with SLI (Specific Language Disorder)

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The aim of this study was the assessment of the incidence of disorders of the central auditory processing in children with the specific language impairment.
Material And Method: The material included 70 children at the early school age that reported to the Audiology and Phoniatrics Clinic with disorders of language development. All children underwent laryngological and phoniatrical examination, including pure tone audiometry and impedance audiometry as well as the evaluation by speech therapist and psychologist. Special questionnaire for parents, providing for the particular criteria of SLI, had been elaborated. Additionally, the electrophysiological tests (N1, P1, N2, P2, P300 waves' records) and psychoacoustic tests of central auditory functions: assessment of psychoacoustic tests (FPT, DPT, GDT , SPN, DDT) had been conducted.
Results: Analysis of results has shown the occurrence of disorders in psychoacoustic tests the frequency and elongation of the P300 wave latency in children with SLI.
Conclusions: In children with the specific language impairment have been observed the coexisting dysfunctions of the central auditory processing that may have a significant influence on process of language development of a child during the physiological period of the communication process development.

FP-099

Comparison of emerging language in young children using Cochlear Implants compared to normal hearing peers

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Aim: This study aimed to evaluate emerging language in young children using cochlear implants as compared to normal hearing peers, using the Di-EL, a parental diary technique
Material and Methods: Two groups of children, one comprising 16 children iwth normal hearing, and a second comprising 24 children with profound hearing loss. Twenty three of these children used a cochlear implant. Data for one child using hearing aids was included in the group. Language data was collected and analysed using the Di-EL, a diary procedure in which parents record the first 100 spoken words used in meaningful context, together with any word combinations.
Results: The normal hearing subject group reached the first 50 and first 100 word targets in a significantly shorter time period as compared to the hearing loss group. Both groups acquired the second 50 words more rapidly than the first 50 words.
Overall, the normal hearing subject group took significantly fewer days to reach the second 50 words and also produced word combinations significantly earlier as compared with the hearing loss group. The size of the single word lexicon was similar for both groups.
Conclusions: The results suggest that despite fitting of devices at an early age, hearing loss continues to impact early lexical acquisition and the emergence of word combinations. Similarities between lexical acquisition and a lexico-grammatical link suggest that the processes underpinning early language acquisition for hearing children and those with hearing loss may also be similar. The study confirms that the Di-EL can be used effectively to assess early language development in children using hearing aids and/or cochlear implants.

FP-100

Naïve users' comparison of BP100 and PontoPro bone anchored hearing instruments

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Background: Bone anchored hearing aids (Baha®) have essentially used the same technology as was used, when it introduced in the 1980s. In 2009 two manufacturers introduced new devices: BP100 from Cochlear and PontoPro from Oticon Medical. Both devices have digital sound processing. Gain and other parameters can be adjusted using a PC program. The aim of this study was to investigate if there was a general preference for one of the two devices among naïve users of bone anchored hearing instruments.
Material and Methods: In an ongoing study, 21 consecutive future adult users of bone anchored hearing instruments were invited to participate and all accepted. All had hearing losses within the fitting range of any of the two test devices. Nineteen participants were fitted unilaterally; two were fitted with devices bilaterally. Regarding hearing loss magnitude and type, the composition of our test group is heterogeneous. The users wore each of the test devices in a daily environment for about one month and after having tested booth devices, they chose which device they wished to keep. Half of the users started with the PontoPro, the other half started the test with the BP100.
The participants rated different aspects of the two devices using questionnaires. Speech tests and measurement of aided thresholds were carried out as well as other audiological tests.
Results: So far 18 subjects have been fitted with the both devices, and 12 have concluded the test. The first test device was loaded 52 –92 days after implantation and each of the test devices were worn for 25–63 days.
Of the first 12 subjects, eight selected the PontoPro for permanent use and four selected the BP100.
Conclusion: The study is expected to conclude by May 2011.

FP-101

Prevalence and structure of chronic middle ear diseases among population of Tajikistan

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Present work is dedicated to analysis of problems of chronic middle ear diseases with detection ratio of conductive and sensorineural hearing loss components. Since hearing loss problems in Tajikistan in terms of determination of ratio of conductive and sensorineural hearing loss forms haven't received special researches so far, its resolve is of essential interest on the largest scale.

Having detected number of patients (580) with hearing impairment we started study of specific weight of particular diseases within the general structure of hearing pathology. During the studies we used the following audiological methods: tonal threshold, superthreshold and speech audiometry, expanded frequency band audiometry, ultrasonic ear investigation (80 kHz), determination of lower limits of frequencies perceived, ototopics study, impedancemetry.

According to the results of surveys carried out, at conductive forms of hearing impairments the percentage of patients with chronic suppurative otitis media and adhesive otitis media, otosclerosis, and hearing loss as a result of incest comes to 61.8%.

Thus, chronic inflammation of middle ear causes injury not only within middle ear structures, but also affects receptor mechanism of auditory analyzer and may serve as a basis for up-to-date targeted treatment and preventive activities.

FP-102

Comparison of Baha Divino and Baha BP100 in patients with single sided deafness using a daily alternating method

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Background: According to single sided deaf Baha users, speech understanding in noise is thus far limited. recently, new Baha devices such as the Baha BP100 were designed to overcome this problem.

Objective: To compare the Baha Divino and the Baha BP100 in patients with single-sided deafness (SSD).

Methods: 20 SSD patients alternated daily between both devices for 2 weeks after a habituation period (1). 10 patients had at least 1 year of experience with Baha Divino (EXP) and 10 patients were newly fitted (NEW). To compare Baha Divino and Baha BP100, speech audiometry in quiet and in noise (S0N0, S0Nbaha, S0Nnbaha, SbahaN0, SnbahaN0) was performed and the APHAB questionnaire (2) and Spatial Hearing Questionnaire (3) were filled out. Patients rated both devices in a diary regarding overall satisfaction, loudness of speech, clarity of speech and loudness of background noise on a scale from 0 to 10.

Results: Speech audiometry shows sgnificant improvement in the aided conditions in specific noise conditions (SbahaN0 S0N0) in both groups but no significant difference between Baha Divino and Baha BP100. On the APHAB, EXP patients rated BP100 significantly better than Baha Divino in background noise. In the diary, a significant difference between both devices concerning background noise (EXP 5.6 *vs.* 3.2 – NEW 4.6 *vs.* 3.7) has been found in noth groups and in the EXP group, patients indicate an improvement with BP100 on all subscales. Most patients declare to be especially satisfied with the clarity of the Baha BP100. Differences between both devices were more explicit in the experienced group.

Conclusions: Subjective assessment using a daily alternating method shows better speech understanding in noise with Baha BP100. Questionnaires confirm these findings. Thus far, speech audiometry in noise does not reveal a significant difference between both devices but further follow-up testing might offer more information.

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FP-104

Evaluation of the Oticon Ponto Pro Power – a comparative study

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Performance of the new Oticon Ponto Pro Power behind-the-ear sound processor for transcutaneous boneconduction was compared to the Cochlear BAHA Intenso using both objective measures (aided thresholds, speech perception) and subjective measures (APHAB, SSQ questionnaires).

Twenty experienced BAHA Intenso users will participate in this study. The results of 17 subjects have now been fully evaluated. Technical characteristics like gain and maximum output levels are highly similar for both devices. Consequently, both devices showed only slight differences in aided pure-tone thresholds. Speech intelligibility in noise as measured with the Plomp and Mimpen (1979) material turned out to be superior for the Oticon

Ponto Pro Power relative to the Cochlear BAHA Intenso with an advantage of 2 dB in signal-to-noise ratio for speech and noise presented in front of the listener. With speech from the front and noise at 90 degrees azimuth related to the fitted side the directional microphones of the Oticon Ponto Pro Power add another 1 dB to the difference, amounting to a total difference of 3 dB in signal-to-noise ratio.
With the APHAB-questionnaire the most prominent effects appear for the categories ‚Ease of Communication' with scores of 36 and 17 and ‚Background Noise' with scores of 66 and 41 for Cochlear BAHA Intenso and Oticon Ponto Pro Power, respectively. With the SSQ-questionnaire the same effects emerge, all pointing to superior performance of the Oticon Ponto Pro Power device. Finally, all 17 users prefer the Oticon Ponto Pro over the Cochlear BAHA Intenso with 13 users showing a strong preference for the Oticon device.
Implications of this study on selection and optimal fitting of boneconduction devices in mixed hearing loss will be discussed.

FP-105

Active implantable hearing devices in patients with moderate to severe sensorineural hearing loss

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Background: Three different types of active middle ear implants were compared viz. the Otologics MET (MET), the Vibrant Soun dBridge (VSB) and the DACS device (DACS). Performance of selected patients with severe, (predominant) sensorineural hearing loss who used one of the middle ear implants was studied. Main selection criterion was the degree of sensorineural hearing loss. Reasons for applying the middle ear implant were either chronic therapy-resistant external otitis (MET or VSB) or, experimentally, because of severe otosclerosis (DACS).
Aim: The aim was to compare outcome of the three devices for patients with similar sensorineural hearing loss.
Methods: 9 MET, 9 VSB and 4 DACS patients from two different implant teams were included in this study. Gain at threshold level, viz. bone-conduction thresholds minus aided soundfield thresholds, was determined. This gain value was divided by the hearing threshold. Per individual and per frequency this ratio was determined and averaged. Furthermore, input-output curves were measured with the devices in linear amplification mode and unlimited output. With these data the in-situ input dynamic range of the devices was determined.
Results: The relative gain for each of the three subgroups of patients was rather comparable with the highest values for the DACS device. These ratios were somewhat lower than generally accepted target values. In contrast, the input dynamic range of the devices was different with the widest range for the DACS device (>45 dB) and the smallest for VSB (30–35 dB).
Conclusions: The (first generation) DACS device seems to have the best capacity to help patients with moderate to severe hearing sensorineural loss who need a hearing implant owing to its accurate dynamic range.

FP-106

Factors influencing the decision for Baha in unilateral deafness: The Bern Benefit in Single Sided Deafness questionnaire

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Background: Bone anchored hearing aids (Baha) are used increasingly to overcome the negative effects of the acoustic head shadow in single sided sensorineural deafness (SSD). It has been estimated that only about 20% of all candidates will decide to use a Baha if given the choice.
Aims: To identify factors which influence the decision for or against Baha in candidates with SSD.
Methods: The data of 46 adults with SSD who were candidates for Baha CROS (contralateral routing of signals) were analyzed. All candidates tested a Baha with a hea dBand in their normal environment. Subsequently, 29 of the candidates chose a permanent Baha CROS fitting, and 17 declined, thus forming the two study groups. For a subset of 28 subjects, the Bern Benefit in Singles-Sided Deafness (BBSS) questionnaire was administered. The questionnaire consists of 10 visual analogue scales rating the subjectively perceived benefit of the Baha or any other CROS device in different situations.
Results: No significant difference regarding age, sex or duration of deafness was found between the two groups. Similarly, transcranial attenuation was not significantly different between those who accepted and declined a Baha. For the BBSS questionnaire, scores were found to be significantly higher for speech understanding at some distance ($p=0.026$), for speech understanding in noise ($p=0.037$), for group conversations ($p<0.01$), and for the overall benefit ($p<0.01$) for those candidates who chose to use a Baha as a CROS device permanently.
Conclusions: Our results suggest that the decision for or against a Baha in SSD is highly subjective. Neither demographic nor audiologic differences seem to be relevant predictive factors. In contract, the subjectively perceived benefit, as measured with the BBSS questionnaire, is significantly different for those who chose a Baha permanently from those who declined.

FP-107

Active middle ear implants or Baha in conductive and mixed hearing loss?

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Introduction: In 2007, Colletti and co-workers published the first results on the application of the Vibrant Soun dBridge (VSB) middle ear implant in patients with impaired middle ear function. Since then several other papers have been published. From these papers, audiologic results were retrieved in terms of effective gain (bone-conduction thresholds minus aided thresholds) and speech recognition, on an individual level.
Material and Methods: Data of altogether 18 adult patients with conductive hearing loss and 40 adult patients with mixed hearing loss could be included. For reference purposes, results of 25 adult patients with conductive hearing loss using the Baha Divino and 22 adult patients with mixed hearing loss, using the Baha Intenso, were included.
Results and Conclusions: In the conductive hearing loss group the Baha seems to be at least as effective as today's active middle ear implants and thus advisable owing to its less-invasive and rather straight-forward implantation technique. In mixed hearing loss with a sensorineural hearing loss component of up to approx. 30–35 dB, the same conclusion seems to be valid. For patients with a more severe sensorineural hearing loss component, the VSB middle ear implant might be the better solution. Further conclusion; while in high frequencies the performance is clearly better with today's middle ear implants, amplification in the low frequencies is obviously better with the Baha. Cross over stimulation with middle ear implants seems to be less of a problem than with Baha.

FP-108

Contribution of monaural and binaural cues to sound localization in aided and unaided bone-anchored hearing aid users

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We examined horizontal directional hearing in patients with acquired severe unilateral conductive hearing loss (UCHL) and in patients with single sided deafness (SSD) fitted with a bone-anchored hearing aid (BAHA).

Sound localization in the horizontal (azimuth) plane requires neural processing of binaural difference cues in timing and sound level. Hence, SSD and UCHL patients have been reported to be severely impaired in localizing sounds in azimuth. However, there exists conflicting evidence concerning localization performance of patients with unilateral hearing. These contradictory results suggest that it might be possible for patients to develop the ability to localize sound, to some extent, monaurally.
To investigate which cues were used to localize sound in azimuth we applied broa dBand (1–20 kHz), low-pass (<1500 Hz), high-pass (>3 kHz), 500 Hz and 3 kHz narrow-band (1/3 octave) noises. Sound levels were interleaved to eliminate the possibility to use the acoustic head shadow effect as a localization cue. The different stimuli were used to dissociate the use of interaural time differences (ITDs) and interaural level differences (ILDs) as localization cues. Note that the BAHA does not restore binaural hearing in SSD patients.
Our results demonstrate that sound localization performance in azimuth was typically poor when patients were tested in the unaided condition. However, 6 out of 20 UCHL and SSD patients demonstrated a fairly good ability to localize sound monaurally. Our results indicate that UCHL and SSD patients with fairly good monaural localization abilities use spectral-shape cues provided by the pinna of their hearing ear. Furthermore, we demonstrate that a BAHA significantly improves the ability to localize sounds in patients with UCHL. The data suggest that UCHL patients and SSD patients learn to some extent to deal with monaural sound cues.

FP-109

The changes of voice in children after cochlear implantation

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Aim: The aim of the study was to assess the changes in the voice of children with cochlear implants.
Material and Methods: 243 children aged 3–12 y.o. were included in the study. In all of them laryngological and phoniatrical examination as well as the fiberoptic assessment of the laryx were performed. The subjective voice assessment icluded evaluation of voice tone, the way of producing the sound, voice attack, voice intensity and phonation time. Next, acoustic analysis of sustained "a" vowel was performed with the use of KAY digital spectrograph including Multidimensional Voice Profile software (MDVP).
Results: Based on the results of subjective and objective analysis it has been stated that the parameters describing voice frequency, amplitude and noise change after cochlear implantation in children
Conclusions: Improvement of voice quality indicates that child's auditory control improved after cochlear implantation.

10th European Federation of Audiology Societies (EFAS) Congress

Posters

PP-01

Tinnitus Questionnaires: Lithuanian practice

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Background. Tinnitus is a severely bothering symptom that accompanies the most auditory pathologies. The international experience proves that the establishing of specialized tinnitus services is an efficient approach to the reliable care of the symptom. The center for the tinnitus management functions in Lithuania since 2010.
Aims: Evaluation of Lithuanian versions of the Tinnitus Handicap Questionnaire, THQ, and the Tinnitus Activities Questionnaire, TAQ, was the primary objective of the study.
Methods: The standard THQ and TAQ, the tools for the assay of the tinnitus distress, were translated into and adapted to the Lithuanian language. All tinnitus visitors were asked to classify own sensations and to fill THQ and TAQ. Furthermore, they categorized the tinnitus according the inquiries of the visual-analogue scale, VAS. The epidemiological data were collected using a self-created questionnaire.
Results: Restricted number of tinnitus cases (17 patients) has been examined up to now. Preliminary results seemed nevertheless reliable. The most subjects, 64.7%, adequately filled the questionnaires. 47% of individuals were females and 53% were males. The mean age was 41 years. 82.4% of subjects felt tinnitus in the ears, while remainder 17.6% within the head. The rate of monaural tinnitus sensation exceeded that of binaural one, 57.1% and 42.9% respectively. In most subjects, 64.7%, the complaint continued more than three months and possessed therefore a chronic character. The most individuals, 64.7%, have been treated earlier. The majority of subjects, 76.5%, complained of a hearing loss also. Hyperacusis happened rarer, 35.3%. Dizziness and/or vertigo accompanied the tinnitus in 23.5% of cases.
Conclusions: Lithuanian versions of the tinnitus questionnaires are beneficial for the study of physical, emotional, and social consequences of the disorder among the local inhabitants. The questionnaires adequately estimate the features of the phenomenon, as well as the outlook of tinnitus sufferers on the event.

PP-02

Hearing evaluation after electrical stimulations of the hearing organ in tinnitus treatment

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Background: A preliminary report on the research is presented. Further evaluation of hearing is planned after 30 and 60 days after electrical stimulations [ES].
Aims: Hearing evaluation after ES of the hearing organ and a comparison of hearing with placebo group.
Methods: 52 tinnitus patients with sensorineural hearing loss were divided into group I (40 patients – 58 tinnitus ears) – treated with ES of the hearing organ and group II (12 patients – 19 tinnitus ears) – placebo group.
ES was performed with a silver probe immersed in 0.9% saline solution in the external acoustic canal. Direct, rectangular current was used, the intensity ranged from 0.15 mA to 1.15 mA. Fifteen ES were applied, 3–4 times weekly. In placebo group the procedure was similar, however no electric current was delivered through the electrode. Evaluation of hearing was done before and after the treatment, on the basis of pure tone audiometry.
Results: In group I – treated with ES, hearing evaluation revealed hearing improvement. Improvement was statistically significant for frequencies 1–8 kHz (≥0.05). In group II – placebo group, hearing level remained unchanged, with the exclusion of single frequency – 3kHz, where statistically significant hearing improvement was observed (≥0.05).
Conclusions: Preliminary study showed positive effects of electrical stimulation on the hearing organ. No hearing deterioration was observed in group I and placebo group.
Considerably better results were obtained in group I – treated with ES, comparing to the placebo group. Nevertheless, further research is necessary.

PP-03

Processes of "Early Bildung" Comparative Bildungs-Studies on hearing and hearing impaired infants in the early parent-infant-dyad

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Background and Aims: The research project »Dialogical Development of Infants« and the follow-on project »Bildung of Hearing Impaired Infants« (Horsch et al. 2004–2011) aim to document and describe early dialogues and early processes of "Bildung".

Furthermore a connection between early dialogic interactions of hearing impaired or normally hearing infants and their parents with early processes of "Bildung" (education) in the context of the newborn hearing screening is evaluated. Therefore different groups (hearing impaired/normally hearing) are compared; the results of this analysis serve as the basis for individualized parent-counselling with the goal to provide access to early processes of "Bildung". Besides, a special attention is directed to the specific parental language as a turn-opening and turn-answering element of the dialogue in the context of language acquisition and early "Bildung".
The study aims to develop and establish empiric research on "Bildung" as a pilot project for research activities targeting this early phase of life for both hearing impaired and normally hearing infants.
Methods: This study is the first attempt of structured scientific and empiric research in the area. Data is collected over the first year of life by monthly video recording of dialogic interactions between hearing impaired infants and their parents over a period of 20 minutes in the natural setting. Afterwards it is compared to data of normally hearing infants by the use of computer-based-analysis (Interact/Mangold). The results will be discussed mainly focussing on occasions for "Bildung" in the context of turn-taking and selected dialogic elements. Various testing procedures were applied in order to validate the data (SAS, ET 6-6, ELFRA).
Results: First results demonstrate that several elements of early dialogic interactions are closely connected to early processes of "Bildung". Significant correlations between the use of selected dialogic elements in families and the score achieved in parent's questionnaires were encountered. Those results differ depending on the child's impairment.
Conclusions: A high potential for "Bildung" in the analysed dialogues – initiated by the child – was found, which prevalently depended on the dialogic attitude expressed in early parent-child-dyads. Since a scientific analysis of early processes of "Bildung" is still missing in early education this study enters completely new and uncharted scientific terrain.

PP-04

Parenting a deaf child – coping with stress by hearing parents of deaf children with hearing aids or cochlear implants

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Background: The parents of deaf children experience parenting stress on a higher level than parents with typically developing children. This kind of stress rises with connection to the child's age. Studies concerning the stress experienced by these parents and their methods of coping with it, with regard to the medical intervention (cochlear implant) as compared to using the hearing aid), bring different results. In Poland such studies have not been conducted before.
Aims: The study addresses ways of stress handling by parents adapting to child's deafness. The question is whether the styles of coping with stressful situations distinguished by Endler & Parker (1990): task, emotion and avoidance style, are modified relatively to the time from diagnosis. Another issue was whether the medical intervention, e.g. cochlear implantation in prelingually deaf children, relates to certain style of stress coping, and whether parents' satisfaction with the decision about cochlear implant is related to their behavior in stressful situations.
Methods: Research is based on a questionnaire containing demographic information about parents (age, sex, education), their satisfaction with the decision on cochlear implantation, and information about child (age at diagnosis and implantation). The Polish version of Coping Inventory for Stressful Situations CISS (Endler, Parker 1994) was used.
Results: Paper presents preliminary results of the study.
Conclusions: Results will lead to practical suggestions concerning psychological help for parents of deaf children, to enable them to cope better with their being a parent of a deaf child.

PP-05

Analyzing sibling relationships of the individuals who have a sibling with hearing aid and cochlear implant

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Aim: The main goal of this study is to analyze sibling relationships of the individuals who have a sibling with hearing aid and cochlear implant.
Material and Method: This study includes 20 individuals having no hearing impaired sibling and 20 siblings of children and adolescents who are followed in the Training Unit of Hearing and Speaking Abilities in Hacettepe University, Department of ENT, Audiology and Speech Pathology Section. The siblings in question are over 12 and they have no hearing loss. 'General Information Form' which aims at gathering information about the individuals participating in the study and their siblings with hearing loss, and 'Sibling Relationship Questionnaire' which aims at identifying qualifications of sibling relationships are used.
Results: At the end of the study, it is understood that the ones in the group having a sibling with hearing loss have gained considerably higher scores in the subscales intimacy/fondness and relative status/strength than the ones in the group having no hearing impaired siblings (≥0.05). On the contrary, the ones in the group having no hearing impaired siblings have gained quite higher scores in the subscales "conflict" and "rivalry" than the ones in the other group (≥0.05).
Conclusions: Psychological and pedagogic consultancy should be given not only to the hearing impaired child or parent of them but also to the sisters and brothers in the institutions which serve to the children with hearing loss.

PP-06

Development of the Program of Early Detection and Rehabilitation of Newborns and Young Children with hearing disorder

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Early diagnosis and rehabilitation program of hearing impairment in infants and young children started working in the Grodno region in July 2007. It is the first regional program in the Republic of Belarus.

Aim: To evaluate the results of three-year period program existence.

Material and Methods: A total amount of 1865 infants referred from maternity hospitals with a risk factor for hearing disorder (RF +) and children with the OAE negative result "refer" were examined. The ABR, DPOAE registration, impedance have been used.

Results: Within 1865 children 136 were scheduled for check-up ABR because the initial result differed from the standard. During the scheduled control examination in 22 children perceptive hearing loss of 2-3 degrees was confirmed, the children received hearing aids. Diagnosis of hearing loss grade 4 was confirmed with 32 children. 24 children were qualified for cochlear implant surgery (during the current year – 12), 20 of them (during the current year – 11) have already been implanted.

Conclusions: Our program permitted to begin the rehabilitation of these children applying modern technology, including cochlear implantation.

PP-07

Adult Hearing Screening: Follow up and outcome measures

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Hearing loss is the third most common condition affecting adults over 65, with well known effects on quality of life. However, a very small percentage of people who might benefit of intervention seek information or help. The Cyprus Pilot Adult Hearing Program targeted adults participating in pensioner organizations and municipality activities. Volunteering adults filled out a demographic/short medical history form, answered the informal question "do you believe that you have a hearing loss", and responded to a five-item list modified from the Hearing Handicap Inventory for the Elderly. Testing included otoscopy and pure tone audiometry at 250–4000 Hz. Referrals were made based on otoscopy or when people had a PTA (1–2–4 kHz) greater than 35 dBHL. A total of 2000 people had participated in the program by March 2011. The referral rate for audiological/hearing aid evaluation was 49%. Referral for cerumen removal/medical evaluation was 16%. Participants who failed the hearing screening or reported difficulty in the questionnaire were offered suggestions for improving visibility of the speaker, seating suggestions for noisy environments, and assertiveness reinforcement. A questionnaire containing questions related to compliance with the referral recommendations and outcomes was completed by telephone for randomly selected participants. The screening, compliance, and outcome findings will be reported.

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PP-08

Screening Speech-in noise 3digit-triplet Hearing-test by phone, scoring, response time and age

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Objective: A screening speech in noise-test made of digit-triplets by phone has been launched in February 2009 in France. 58000 calls were made within 2 years.
The results of the screening (good, insufficient, poor) were consistent with previous studies by the test promoter. (K.U. Leuven)
As this test was mainly designed for seniors, we wanted to know if the results were age-dependent. We decided to study the variations of response time.
Study sample: A sample of 1000 calls among 58000 calls.
Design: The callers have been studied for age, response time, number and sequence of errors. Statistics were made (ANOVA)
Results: Response time increases with age, incorrect answer and low signal/noise ratio. Response time is independent of the group in which belongs the caller (good, insufficient or poor)
Conclusions: The 3digits-test by phone is valid for hearing screening-test. We want to match it with immediate memory tests and cognitive assessments.

PP-09

Psychoacoustic tests for central auditory processing: Normative data

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The comprehension of spoken language is based on the analysis of complex acoustic signals by the central auditory system. Direct relationships between gradual, spectrotemporal modifications of speech sounds and the impairment of the comprehension of such altered sounds have been found in many psychophysical studies. Thus, it is reasonable to assume that deficits in the understanding of speech seen in patients with acquired brain lesions may, to a certain degree, result from impaired central processing of acoustic signals. In this manuscript we report normative data collected from 94 young normal-hearing subjects on a battery of psychoacoustic tests designed to evaluate signal processing at different levels of the central auditory system.
Monaural pure tone thresholds were used to evaluate the performance of peripheral hearing. The integrity of auditory brainstem processing was evaluated by quantifying Masking Level Difference (MLD) values and Gap Detection (GD) thresholds. Three monaural speech tests (Time-Compressed Speech-CS, Filtered Speech- FS and Speech in Noise-SIN) were conducted to evaluate the processing of distorted speech materials by cortical auditory processing mechanisms.
Evaluating performance of naïve, young normal-hearing subjects, as we do here, is indispensable for (a) evaluating the effectiveness of potential tests, (b) evaluating their suitability for the examination of patients, and (c) the revision and further development of central auditory tests.

PP-10

The effects of language processing on identification of central auditory processing

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Background: Central Auditory Processing (CAP) disorders are neural processing disorders of the auditory stimulus they do not include language and cognitive processing (ASHA, 1996). The acoustics of stimulus,transformed to the receptive and expressive language is composed of stages, respectively, processing of acoustics of stimulus, processing of speech sounds and matching with meaning. Although language processing (LP) and CAP are related to each other, they have different functions. CAP includes sound localization and lateralization, auditory discrimination, auditory pattern recognition, temporal aspects of audition, auditory performance in background of noise and auditory performance with degraded acoustic signals.
Aim: The aim of the study is to evaluate the effects of CAP functions on LP in children.
Methods: Turkish version of the SCAN-C (Keith,2000), for assessing central auditory processing, and CELF-4 Preschool -2. edition for assesing language processing, was conducted with 27 children (hearing, verbal communication and academic achievement is normal) between the ages of 6:0 to 6:11 months in the sound threated room.
Results: Scores of the 4 subtests of SCAN-C and scores of the 9 subtests of the CELF-4 tests were compared with Pearson Correlation Analysis in this study. Competing Words and Competing Sentences subtests were positively correlated (%5) with phonological awareness subtest. This relationship were found ‰ 1 positive when the stimulus was presented from right ear.
According to these results, even though CAP is not associated high-level language function, CAP and APD positive relationship in the phonological awareness may be due the acoustic–phonetic features of the language (not semantic) that differentiate sounds (the small temporal differences cannot be resolved). This results may contribute to differential diagnosis of APD.

PP-11

Attention control and brain asymmetry for language processing. Results from functional magnetic resonance imaging (fMRI) and central auditory processing assessment

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Aim: The aim of the study was to assess the relation between brain asymmetry for language processing and the phenomenon of Right Ear Advantage in verbal processing in the context of different attention involvement.

Material and Methods: Subjects in the study were 10 healthy male youth aged 11–16 (M=13, SD=1,76). All of the subjects were right-handed and were given written consent for the procedure by the parents. For each of the subjects the fMRI protocol for hemispheric language dominance assessment was conducted together with the central auditory processing assessment outside the scanner including dichotic listening tasks. The latter involved alternatively top-down or bottom-up auditory processing, depending on the examination procedure.

Results: High correspondence in determining brain asymmetry for language processing between functional magnetic resonance imaging and dichotic listening tasks' scores was found. Moreover, the relation between Right Ear Advantage and the degree of brain asymmetry for language processing depended on the dichotic tasks' procedure (the involvement of bottom-up vs top-down processing). Correlation was found only in task requiring conscious redirection of auditory attention.

Conclusions: The results show complexity of the relation between brain asymmetry for language processing and Right Ear Advantage in verbal processing. It seems that attention involvement mediates this relationship. However, the results should be taken with caution due to small number of subjects participating in the study.

PP-12

Features of speech processor fitting during cochlea obliteration and Split-electrodes usage

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Background: Today, there is a possibility of cochlear implantation (CI) with cochlea obliteration after meningitis suffering. However, some patients, because of cochlea tonotopic disorder, should have implant fitting in a particular way.

Aim: Fitting features determination of speech processor using the Split-electrode for patients with cochlea obliteration.

Methods: At the ORL-clinic of Dnepropetrovsk State Medical Academy, 105 CI have been made since 2006. There were 3 patients at the age of 3, 18 and 33 who had cochlea obliteration because of meningitis. The operation was made in time up to 7 months after meningitis. We used implants with dual Split-electrode by MEDEL.

Results: Adult patients had frequency scaling for subjective determination of frequency stimulus. According to its data, electrodes programming was made in a definite order.

One year after CI, two patients (aged 3 and 33) had growing resistance on 6 channels up to 12–20 kOhm. Probably, it happened because of the growth of connective tissue around the electrode in cochlea. On these channels, we increased the stimulus duration up to 70 μs (standard is 26 μs) and reduced value of the most comfortable level. Two more channels had resistance more than 20 kOhm, and they were disconnected.

[**Conclusions:** The Split-electrode usage allows to implant patients with cochlea obliteration. Thus it is necessary to control the electrodes position using the 3D-tomography after the operation. Adult patients should be carried out frequency scaling and it is necessary to program electrodes according to its results. In case of a significant resistance growth on certain channels, electrodes need to be disconnected. Obliteration progression can lead to total cochlea ossification and nerve degeneration and cochlear implant will not cause auditory sensations. The only alternative is brainstem implantation. Patients should be informed about it.

PP-13

Balance function in Cochlear Implant recipients assessed by the vestibulo-spinal reflex

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Background: Balance alterations in the postoperative Cochlear Implant (CI) surgeries vary from 31 to 75% (Bonucci et al., 2008).
Objective and Methods: this study comprised 20 adults who underwent unilateral cochlear implantation. They were compared to 20 well-matched controls. The aim was to assess balance function in CI recipients using sensory organization test (SOT) of computerized dynamic posturography (CDP) and to compare the findings with vestibular evoked myogenic potential (VEMP) which assesses the vestibulo-colic reflex, another vestibulo-spinal reflex test; and to correlate findings of these 2 tests with the patients' imbalance symptoms.
Results: Vertigo was present in 5/20 CI cases. Eleven had post-operative dizziness. Thirteen out of 20 cases had SOT abnormalities, 10 of which had vestibular ratio abnormality. The cases had a statistically significant lower SOT composite score, equilibrium strategy scores in conditions 4, 5 and 6 as well as vestibular, visual, visual preference ratios than their controls. There was a statistically significant correlation between the vestibular ratio and post-operative vertigo and dizziness, and between composite score and post-operative dizziness. Eleven out of 20 had preserved VEMP response, out of which 6 had normal VEMP and 5 had abnormal inter-aural difference in amplitude, which was statistically significantly lower than controls. The remaining 9 had lost VEMP irrespective of the tested side. Statistically significant differences with regard to P13 latency were found comparing implanted non-implanted ears, as well as comparing implanted ears with the controls. There was no statistically significant correlation between patients' age, duration of sensory deprivation, implant duration or total hearing loss duration with any of the posturographic or VEMP parameters. And both tests were not correlated.
Conclusions: Balance dysfunction is not uncommon in CI recipients post-operatively, requiring vestibular rehabilitation. We recommend adding CDP and VEMP to the routine pre-and post surgical testing.

PP-14

Fine Structure Processing coding strategies in cochlear implants improve speech perception

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Background: Recently new speech coding strategies have been developed to improve speech reception in cochlear implant (CI) users.
Aim: To evaluate speech reception in noise with Fine Structure Processing (FSP) strategies
Method: 32 experienced CI users were included in this study. FSP was implemented in 22 patients. 10 patients continued to use CIS strategy. Testing was performed at upgrade and after 1, 3, 6, 12 and 24 months of FSP/HDCIS use. Speech perception in noise was measured and the Speech, Spatial and Quality of Hearing Scale (SSQ) questionnaire was administered at each testmoment.
Results: Speech perception in noise improved significantly with 6.5 dB after 12 months of FSP use. A further improvement of 5.4 dB (p= 0,001) was measured after 24 months of FSP use. No significant improvement in speech perception was measured in the group using HDCIS. The SSQ questionnaire showed a significant improvement on the Spatial subscale (p= 0,009).
Conclusion: New speech coding strategies, such as FSP, can improve speech perception in noise by enhancing temporal cues. Further research remains necessary to investigate clinical benefit of new coding strategies.

PP-15

One year follow-up results of young children switch-on with hires 120™

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Background: The HiRes 120™ sound coding strategy from Advanced Bionics™ implements virtual channels by steering current between two adjacent electrodes. In this way the number of stimulation sites is no longer limited to 16, the same as the number of electrode contacts but may be extended to 120 locations which correspond to 120 spectral bands.
Aims: The aim of this project was to evaluate the benefit of the HiRes 120 sound coding strategy for speech production, perception and music development over a 24 month period in children.
Methods: Children between twelve months and four years of age are included in the evaluation. All subjects are first fitted with HiRes 120 using either their Harmony™ or Platinum Sound™ processors. Pre-implantation, baseline is evaluated using the Children's Implant Profile (Nottingham Version) and a free field audiogram if available. The children are evaluated with a series of questionnaires: MUSS, (IT) MAIS, SIR, CAP, PRISE and a Musical Stages Profile at approximately 3, 6, 9, 12, 18 and 24 months. Performance data using the clinic's routine tests are collected.
Results: 43 subjects from 10 centres were included in the survey. The data obtained so far up to 12 months showed a clear increase of the scores from session to session for all the questionnaires. In addition, most of children are within the normal hearing range for the (IT) MAIS and PRISE questionnaires.
Conclusions: Data collection is ongoing; the first outcomes are very promising in terms of acceptance and performance with HiRes 120.

PP-16

Fine Structure Processing (FSP) strategy in patients after Partial Deafness Treatment (PDT)

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Background: Recent advances in technical developments with cochlear implant speech processors have opened new listening possibilities for cochlear implant users. The release of the MAESTRO 3.0 fitting software allowed for backward compatibility, which allows COMBI 40+ users to be fit with the OPUS 1 or 2 and DUET 2 audio processors using the two new coding strategies: FSP and HDCIS.
Aim: This study aimed to assess FSP strategy in PD patients with long-term experience with the C40+ or Pulsar cochlear implant and DUET speech processor, who have received an upgrade to the DUET 2.
Material and Methods: Ten adults, age ranges at upgrade from Duet processor to Duet 2 from 29 years to 72 years who had minimum of 12 months of DUET experience were fit and tested with the DUET 2. The average age at upgrade was 43 years (29–72 years). The patients were tested with all available strategies (FSP, HDCIS, CIS+) using the speech reception tests in quiet and in noise. They also completed Visual Analogue Scales (VAS) questioning satisfaction, when listening to speech and to a pop song. Tests were administered at two intervals: at the FSP switch on (interval I) and 3 month of FSP usage (interval II).
Results: Results for the speech reception test in quiet and in noise revealed no statistical significant effect of strategy According to the results of the VAS satisfaction results an overall significant effect was reached for strategy (p=0.05) for music sounds. Post-hoc analyses using the Holm-Sidak test showed a statistically significant difference with FSP better than CIS+ by 19% (p=0.04) Fine Structure Processing (FSP) strategy in patients after Partial Deafness Treatment (PDT).
Conclusions: The FSP can provide additional advantages to the patients with partial deafness after cochlear implantation.

PP-17

Construction of music test tailored to meet the needs of patients after Partial Deafness Treatment (PDT)

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Music enjoyment constitutes meaningful factor influencing the benefit of implantation. Combined electric-acoustic stimulation

can significantly contribute to the improvement in quality of hearing.
Aim: Development of music test battery to assess the benefit of electric acoustic stimulation.
Material and Method: The PDT Music Test was created with the use of samples from "The Mu.S.I.C. Test". To meet the need of the target group – PDT patients - two versions of the Test have been formed: low – with fundamental frequencies below C3 (131 Hz) and high – with fundamental frequencies above C3. For each version 6 configurations have been composed: Pitch, Melody, What Instrument, Number of instruments, Chords. The group of PDT patients was tested in three conditions – electric stimulation (ES), acoustic stimulation (AS) and combined stimulation (EAS).
Results: The PDT Music Test was created and applied to the group of PDT patients. Preliminary results indicate that the Test is able to depict other than audibility differences of perceived quality of music in three conditions (ES, AS, EAS)
Conclusions: The PDT Music Test can be used as complementary tool in the procedure of fitting of eas patients.

PP-18

Assessment of voice in children with Partial Deafness Treatment (PDT)

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Aim: The objective of this research was to assess acoustic parameters of voice in children with partial deafness.
Material and Methods: The material included 137 children aged 5–12 y.o. Voice was recorded directly on a hard drive using CSL 4300B KAY Digital measurement interface. All generally approved studio conditions were provided for the recording. Prolonged phonation on the vowel „A" was recorded by each patient. Results of the acoustic research were analyzed.
Results: Analysis of the acoustic parameters indicates statistically essential differences in acoustic parameter values that describe changes in frequency, amplitude and parameters defining noise components within children with normal hearing and partial deafness. Additionally differences in acoustic structure of voice of younger children – aged 5–6 y.o. and older children aged 7–12 y.o. were found.
Conclusions: Partial deafness with prelingual onset causes changes in acoustic structure of voice in children.

PP-19

The dynamics of the maintenance of residual hearing in patients with partial deafness after cochlear implantation in a short period after surgery

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Backgrounds: Proposed and introduced into clinical practice innovative method of cochlear implantation by Professor H. Skarzynski resulted in the possibility of preserving residual hearing in most patients after implantation. Several years of observations of patients the so-called partial deafness leads to the conclusion that it is a safe method and the results achieved by patients in audiometric testing are reproducible and stable over time. An interesting phenomenon is, however, the dynamic changes and stabilization of residual hearing in the short postoperative period and the associated fluctuations in hearing loss, especially during the first 3 months after surgery. This paper aims to illustrate the dynamics of these changes on selected cases of patients implanted at the Institute of Physiology and Pathology of Hearing in Warsaw.
Aims: The aim is to present the dynamic maintenance of residual hearing in patients implanted in a short period after surgery.
Methods: Pure tone audiometry tests were carried out on a group of 15 patients implanted unilaterally at intervals of 24 hours before and 48 hour, 10 days, 1 month and 3 months after.
Results: Observations on preservation of residual hearing in patients implanted by the method proposed by Skarzynski, show significant fluctuations in hearing threshold in the first weeks after surgery.
After a short period of significant deterioration of hearing, it is noted that after that time in most patients after surgery hearing thresholds have similar values to those before the implantation.
Conclusions: Observation of dynamic maintenance of residual hearing suggests the need to revise our understanding of the processes occurring in the inner ear, and trauma associated with decompression cochlea, which in many cases is temporary. Surgical method of approach by the round window in the case of placing the electrode into the cochlea is a safe solution and guarantees the preservation of residual hearing in the majority of operated patients.

PP-20

Effect of different hypothermic techniques on Cochlear function in children after open heart surgery

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Background: Mild to moderate hypothermia forms are the basis of neuroprotective strategies during cardiopulmonary bypass operations. Mild hypothermia has a protective role on the cochlea and could prevent its damage during long lasting operations. However, deep hypothermia may result in cochlear cells injury.
Objectives: This research aimed to assess the effect of different hypothermic techniques on cochlear functions in children after open heart surgery using otoacoustic emissions.
Subjects and Methods: Forty children with various acyanotic heart diseases who underwent open heart surgery were included in this study. They were subdivided into two groups; Group I : twenty patients who were subjected to mild hypothermic technique (33–37°C), Group II : twenty patients who were subjected to moderate hypothermic technique (28–32°C). Audiological assessment included both basic evaluation and otoacoustic emissions testing. Results: All patients had normal hearing. Both study groups had DPOAEs amplitude (≤3 dB SPL) at all frequencies. However, group II showed lower amplitude at all frequencies with statistically significant difference at high frequencies (4.416–8.837 KHz) compared to group I (≥0.01). TEOAEs showed partial pass in three patients of group I (15%) and in fifteen patients of group II (75%). Moreover, Group II showed statistical significant reduction in the overall TEOAEs amplitude as well as at high frequencies (2–4 KHz) (P≥0.01).
Conclusions: Patients exposed to moderate hypothermic technique had subtle cochlear dysfunction. Care should be taken for choice of moderate hypothermic technique in open heart surgeries for children at risk for sensorineural hearing loss.

PP-21

Automatic sonomotor wave removal system for Auditory Brainstem Responses

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Aim of this study was to develop a computer system capable of automatic detection and removal of sonomotor waves from Auditory Brainstem Responses (ABR) and to assess its clinical appliance. Auditory brainstem responses are recordings of changes of electric potential on the scalp in response to a given auditory stimulus. Their amplitudes are measured in tenths parts of microvolts and can be considered very small on the background of artifacts from ongoing spontaneous electrical activities. Because ABRs are tightly associated with the auditory stimulus, contribution of those additional activities can be decreased by means of averaging of single responses and rejection of responses with artifacts. However, this techniques can't be applied in case of artifacts associated with stimulus like for example sonomotor waves, commonly seen in ABR waveforms for high stimulus intensity. Sonomotor wave removal is especially important in automatic ABR response detection systems. Our approach is based on adaptive decomposition of the signal using redundant set of Gaussian and 1-cycle-limited Gabor functions and extraction of sonomotor wave component. In order to estimate optimal parameters and evaluate efficiency of the system simulated data were used. Also its performance has been evaluated by means of clinical data. Results were judged by experts with many years of clinical experience in ABR evaluation.

PP-22

Assessment of effectiveness of algorithms applied in Vivosonic Integrity device for rejection of muscle artefacts in ABR recordings

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Registration of auditory brainstem responses (ABR) is commonly used in hearing examinations in young children. It is recommended to perform these tests in natural sleep, in order to reduce the influence of muscle artifacts (resulting from child's movements). In clinical practice, however, it is not always possible to test a sleeping child, and the examinations are often carried out in the state of arousal. Restlessness of the child deteriorates the quality of ABR registration, and increases examination time. For many years, researchers have been looking for effective methods of artifact rejection in ABR recordings, in order to increase signal-to-noise ratio, to shorten registration time, and improve repeatability of measurements. For example, in the Vivosonic Integrity device, advanced methods of artifact rejection are implemented, which theoretically allow for reliable ABR recordings not only in sleeping children, but also in children being awake (i.e. at play). The aim of the work was to assess effectiveness of artifact rejection algorithms applied in the Integrity system. In a group of 56 children, the values of wave V thresholds obtained in tests carried out in children at play were compared with those measured in sleeping children. Additionally, both threshold values were compared with reference ones, determined in sleeping children by means of the EPTEST electrophysiological system. The possibility of reliable ABR registration was assessed for responses evoked by click stimuli, as well as for ABRs elicited by tone bursts. We also measured examination times in sleep and arousal conditions and evaluated the difference.
The results showed that it was possible to reliably determine wave V threshold of click-evoked responses in all examined children, irrespective if the child was examined in sleep or at play. However, when using tone-burst stimuli, the threshold values

determined at 500 Hz by the Vivosonic Integrity device in children at play were consistent (within 10 dB interval) with those determined by the EPTEST system in about 30% of cases, and in approx. 50% of cases at 1000 Hz. In sleeping children, threshold values measured by the two systems did not differ more than by 10 dB, irrespective of the kind of stimulus. Average time of ABR registration in children at play was, on average, twice longer than that required for sleeping children.
The results obtained in this study confirm usefulness of the Vivosonic Integrity system for hearing threshold examination in young children in natural environment (at play) as long as click stimuli are used. However, when we apply frequency-specific stimuli, it is recommended to examine the child in sleep.

PP-23

Being deaf – what does it mean? Study on prelingually deaf adolescents from hearing families

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Background: Being a deaf person and experiencing own deafness is related to the quality of the child's interpersonal relations with the closest people, including the mother and the father. It is from them – by the means of emotion exchange – that they learn for the first time what it means to be deaf. That is why experiencing oneself as a deaf person in the later part of life has its roots in the emotional meaning of the child's deafness for its hearing parents and the way they managed it psychologically.
Aims: The aim of this study is to learn what meaning has deafness for the feelings of deaf teenagers with various educational paths and modes of communicating with the environment. What does being deaf entail in terms of their perception of themselves and the surrounding world? What emotions are connected with this? Is being deaf equivalent to being disabled, different, inferior?
Methods: In order to recognize the individual meaning of deafness for prelingually deaf teenagers with hearing parents, the qualitative method was used (i.e. interview and narrative analysis). The interview 'What is it like to be deaf' was used to interview 20 young deaf people in the age of 18 to 22 years old who had high oral and/or sign language skills. The interviews were recorded and transcribed. These transcriptions were then analyzed in relation to the content regarding deafness with the usage of the 'competent judges' method.
Results: The results have shown that the main dimensions of the self-perception of the deaf teenagers are: a) difficulties in speaking and communicating with the environment, b) "lack of something" (the feeling of "being defective"), c) loneliness, isolation and fear in social situations, d) negative emotions such as shame, sadness, fear, e) deafness conflict.
Conclusions: The results point to the need to offer young deaf teenagers with high oral and/or sign language skills various forms of psychological help in order to help them experience themselves as a deaf person in a positive way and to help them see their deafness as a distinctness rather than a disability. The parents of the child also need psychological help, from the moment of diagnosis, in order to help them to work through the trauma of their child's deafness.

PP-24

Sign language and verbal expression in deaf and hard of hearing children of preschool age

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In the development of language and speech in deaf and hard of hearing children of preschool age, signs play a significant role.
The level of adoption of sign language, from an early age, facilitates the ability of deaf children to familiarize themselves with the world, to develop cognitive abilities, to communicate with their parents and the environment around them.
Vocabulary development is not only reflected in the expansion of its scope; but the meaning of those words as well.
Through play, a deaf child learns to pronounce words and notions which are signified by that word.
The aim of our study was to evaluate the lexical dexterity in deaf and hard of hearing children of preschool age. The sample was 10 deaf and hard of hearing children.
The instrument utilized in this study is: The Test for Evaluating Lexical Dexterity (Dimitrijevich, Djordjevich).
Deaf and hard of hearing children of preschool age utilized on average a larger number of signs than spoken words.
Certain differences were observed in certain lexical areas, in comparison with the total number of words and the number of varying words, in relation to different ways of expression.
Non-verbal and verbal communication should be developed through all spontaneous and directed activities of deaf and hard of hearing children.
Development and vocabulary building should be done by way of exercises, which involve the enrichment of the lexical stock of children and their empowerment to adequately use words as part of their speech.

PP-25

Bert Rehab Series

Herrmannova D.

Rehabilitation and Education Counsellor, Advanced Bionics

This new Advanced Bionics rehab material was designed by the professional – speech and language therapist with long experience working with the deaf children and children – cochlear implant users.
This equipment is focused mainly to children – cochlear implant candidates and users to help them to develop different vocabulary, hearing skills, sound memory, listening and communication skills together with their therapist and parent.

Bert Rehab Series contain of 3 different sections:
- Bert Rehab Posters,
- Bert Rehab Memory Cards,
- Bert listening DVD.

The lecture will introduce and explain this new rehab material and the use of it in details.

PP-26

Hearing in children with craniofacial anomalies

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Cleft lip and palate are complex congenital anomalies. They lead to complex esthetic, functional, articulation, hearing and in the course of life even social problems. Etiology of occurrence of this dental-facial anomaly is complex and not fully clarified. In the majority of cases cleft lip and palate occur due to coactions of many unfavorable factors, and only rarely due to the influence of individual factors.
Because of changed anatomy and morphological structure, children with cleft palate as a group have a high risk in population, for damage hearing.Specific number of children with cleft palate also have a hearing loss, which more complicates voice rehabilitation. Research indicates that the incidence of hearing loss in children with cleft palate is not negligible. Up to some dates the percentage ranges up to 23%.
In our study included children with cleft palate and hearing impairment, normal intellectual abilities, both sexes, at the age of 18 months to 3 years.All subjects were patients of the Institute of psycho physiological disorders and speech pathology Prof. Cvetko Brajovic, in Belgrade where they come to speech-language therapy.
Auditory perception was investigated by AEP and the obtained results were our parameters, which were in the process of voice rehabilitation periodically examinated.
These results showed that children with cleft palate present group of high-risk children for the development of damage.Severity and type of damage depends on many factors, in the initial phase of hearing loss is conductive type and later it becomes perceptive damage, and is not timely detected by initial failures in the auditory resources, or if the child is not adequately treated.
Early diagnosis of cleft palate anomalies enables the causes of irregularities to be timely eliminated so that the habilitation-rehabilitation procedure would be more successful.

Key words: hearing disorders, cleft palate, prevention

PP-27

Home rehabilitation clinic (HRC) – the proposition of solution of organizing rehabilitation close to patient's home

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Aim: The aim of the program is to make use of the knowledge and achievements of the multidisciplinary team of specialists in order to create and implement the efficient treatment programs, and to assist in their rehabilitation, education and social adaptation.
Material and Methods: The HRC program includes: the set of materials, training and workshops for specialists from Regional Units, teaching for patient's parents/caregivers, group and individual consultations conducted from the Monitoring and Coordination Center and the Regional Units, using the network of internet connections.
Results: HRC allowed to: Prepare 1754 families for using this completely new therapeutic solution. Reduce the costs of long-term rehabilitation of children and adults. Facilitate the assess to the best specialists and considerably improve the comfort of the whole rehabilitation process for patients.
Conclusions: The HRC program, designed to organize rehabilitation close to patient's home and changes the popular opinion, that the best place to organize long-term rehabilitation is the specialist center.

PP-28

Application of the auditory training in children with the attention disorders

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Background: Parents of children with attention disorders often complain about their hearing problems. It appears that many of them have central auditory processing disorders – it means that they do not have problems with the hearing but with the listening.
Aims: The aim of this work is to present the results of children with attention problems, who have the central auditory processing disorders, after the therapy they received in the Institute of Physiology and Pathology of Hearing.
Material and Method: Materials includes a group of 70 children. The therapy applied was the auditory training specially developed in our Institute for children with attention disorders. It consist of the passive phase, during which patient is only listening

to specially modified sounds, and the active phase when patient performs exercises specifically adjusted for his type of disorder.
Results: In this work we present the effects of therapy for patients immediately after the finish of the therapy (70 children) and half year after the therapy (30 children).
Conclusions: Studies and results of tests show that patients who finished therapy in the Institute of Physiology and Pathology of Hearing show improvement of central auditory processing, resulting in the diminution of their listening problems.

PP-29

Diagnosis and therapy of specific speech articulation disorders caused by CAPD

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Background: People with normal hearing may have different central auditory processing disorders (CAPD) causing difficulties with verbal communication, education and everyday functioning.
Aims: This work presents diagnostic approach and results of the therapy of children with CAPD coexisting with the specific speech articulation disorders.
Methods: 35 children have been examined before, at the end of and six months after the therapy. All patients were undergoing a therapy, during which they were listening to a sound material (passive phase) and performing different exercises adjusted to their individual needs and abilities (active phase).
Results: The majority of patients enrolled in the therapy attained the improvement in auditory abilities and everyday functioning maintaining in time. The examination conducted six months after the end of the therapy showed that auditory skills in patients who additionally had sensory integration problems returned to the pre- therapy level.
Conclusions: Motor and sensory integration deficits influence the gaining and maintaining of the auditory skills.
Auditory training developed in the Institute of Physiology and Pathology of Hearing is an efficient form of therapy of children with CAPD coexisting with specific speech articulation disorders.

PP-30

A new research implementation of MP3000™ to improve intermediate pitch percept between electrode contacts

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Background: MP3000™ is the first commercial signal processing strategy for cochlear implants making use of a psychoacoustic masking model derived from normal hearing listeners. It reduces the number of electric stimuli inside the cochlea thus lowering channel interaction and power consumption without compromising speech understanding. However, due to the intrinsic behaviour of psychoacoustic masking models, stimuli generated by MP3000™ are relatively isolated compared to stimulation patterns created by the ACE strategy. Therefore the perception of virtual channels may be reduced when using MP3000™. To avoid this problem, a research variant of MP3000™ named V-PACE is currently under investigation. This strategy still uses the psychoacoustic masking model, but instead of selecting isolated channels, pairs of neighbouring channels are always being selected, such that the principle of intermediate pitch percept between physical electrode contacts should be maintained.
Method: 12 subjects have been recruited for the study and will be evaluated with an ABCCBA cross-over design. The three conditions are: MP3000™ (5 channels), V-PACE-half (5 channel-pairs, half stimulation rate per channel) and V-PACE-full (5 channel-pairs, full stimulation rate per channel). Besides speech perception tests in noise and competing talker tests, pitch discrimination and melody recognition skills are being used to evaluate the different conditions. In addition subjective preference in different listening situations will be evaluated by using the APHAB questionnaire.
Results: Preliminary data indicate a preference towards V-PACE. Until now, no significant improvement of speech performance and pitch discrimination over MP3000™ could be found with V-PACE. Further results will be presented at the conference.

PP-31

Computer assisted outcome based fitting: Preliminary results of the FOX® study in Advanced Bionics' users

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Background and Aims: State-of-the-art cochlear implant programming software is essentially technical. It exposes many control parameters, such as strategy options, electrical mapping levels, audio input control, … to the CI expert audiologist. The role of the CI audiologist is to know how to set these parameters in order to optimize the hearing performance of the CI user. The FOX® fitting system, developed by the Eargroup takes a different approach: it proposes an audiological workflow with specific hearing milestones such as detection of soft sounds, phoneme discrimination and speech in quiet. Meeting these goals is supported by provision of clinically credible switch-on programs, assessment tools for these hearing tests (A§E test suite) and a FOX® agent that proposes fitting recommendations based on the outcomes. Advanced Bionics has organized a European multi-centric study to evaluate this approach in new users and evaluating its efficacy and time efficiency.
Methods: Two subject groups, the control and the FOX group are being investigated from the initial switch on over a period of six months. Fitting time requirements, learning trajectory and overall performance based on speech assessment in noise at the end of the study will be compared between the two study groups.
Results: FOX is in use in the Eargroup since June 2008. All implant users receive FOX based fittings. Immediate positive effects are seen on the audiogram, the speech audiogram, the phoneme discrimination task and the loudness increase test. The preliminary results of the multicentric study will be presented.
Conclusions: The introduction of fully automatic and outcome driven expert software has the potential to substantially reduce the fitting time and to provide good fitting quality. It may further standardize and systematize the fitting procedure and help improving the fitting expertise.

PP-32

Identification of musical instruments by CI users through earphones and in sound field conditions

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Spectrotemporal information of the stimulus delivered to the auditory nerve by current Cochlear Implant (CI) technology is still insufficient in providing an accurate representation of the timbre of musical instruments at a perceptual level. This fact associates with poor performance in instrument identification by CI users, especially in cases when more than one instruments sound together. Listening conditions have also been shown to affect identification performance.
The aim of this study was to explore the ability of 13 unilaterally implanted adults wearing a MEDEL's PULSAR CI^{100} or a SONATA TI^{100} implant and using an OPUS2 speech processor, to recognise musical instruments in recorded solo and ensemble performance. The influence of specific listening conditions (listening via earphones vs. in sound field conditions) was also a central issue of this investigation.
All participants were first listened to short pieces of recorded solo performance from selected instruments (oboe, piano, trumpet, violin, viola and xylophone) and voice (soprano, tenor), and they were asked to identify the instrument played in solo. Then they were required to identify individual instruments while they were listening to short recordings with up to five instruments (cello, flute, snare drum, xylophone and trumpet) playing in ensemble. Both tests were performed in two sessions in a sound-attenuating room at an average SPL of 75 dB(A). In the first session music was presented via earphones, while in the second, participants faced a speaker that produced the recorded music at a distance of 1 m.
Analysis of identification scores showed that listening in sound field associates systematically with high probability and well-above-chance level of correct identification of instruments in both types of performance (solo and ensemble performance), while listening through earphones associated with reduced identification sensitivity, which varied considerably across instruments. However, particularly noticeable distinctive spectrotemporal features of the sound of an instrument (e.g. sharpness of sound attack, vibrato) minimized identification contrasts between listening conditions.

PP-33

Cochlear implant and vestibular function

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Background: Bilateral vestibular function considerably affects human balance.
Aim: The aim of this study was to evaluate the impact of the surgery for cochlear implantation upon the vestibular function.
Methods: Vestibular function was evaluated in five adult candidates for cochlear implantation before surgery by means of bed-side examination, computerised dynamic posturography (CDP) and electronystagmography (ENG). They were monitored and retested one week after surgery (bed-side examination and CDP) and one month later (bed-side examination, CDP and ENG).
Results: Out of five patients, just one showed unilateral hyporeflexia in caloric test before surgery. Evaluation one week after surgery (SONATA CI) showed nu spontaneous nystagmus and normal, but lower stability scores in PDC. Follow-up at one month revealed normalisation of CDP scores and no equilibrium problems. The patient with unilateral caloric hyporeflexia before surgery was implanted in the cochlea with normal vestibular function due to associated anatomical factors in the ear with no worse vestibular function or equilibrium after implantation.
Conclusions: We consider that vestibular function might impede upon CI surgery results and it should be taken into consideration when choosing the ear to be implanted. Still, in our patients investigated in this respect no significant equilibrium problems occurred. This result might be also correlated with the small diameter of the array used (SONATA CI) and soft surgical implantation.
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PP-34

Champions profile for evaluation of paediatric cochlear implant users with complex needs – European retrospective study

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Introduction: In the last years the inclusion criteria for cochlear implantation have been widened. The consensus is growing that additional disabilities are not a contraindication. Therefore more deaf children with complex needs receive cochlear implants. Following implantation, their unique combination of disabilities makes the potential of these children difficult to evaluate and progress difficult to monitor. Not all of the traditional outcomes, typically measuring speech perception or production, will be predictable, or indeed applicable, but the experience of having a cochlear implant (CI) may bring exciting and significant life rewards.
Objectives: This survey introduced the "Champions" profile to assess the influence of cochlear implantation on medical and audiological aspects, communication strategies, social and psychological aspects as well as quality of life. The objectives were to verify the profile and to determine the usefulness of data gathered for the potential management of complex needs children.
Material and Methods: Children with complex needs from four European centres were evaluated using the 'Champions' scales. The data were analyzed to illustrate and compare the important outcomes for these children in terms of everyday life. Data collection is underway with a target of 52 data sets to be completed for analysis. Initial results point to the different development and benefits from CI for children with complex needs as well as quality of life.
Results: The graphic presentation of the scales makes it easy to see the areas in which progress has been good and those areas in which the child will benefit from more intensive support. The Champions evaluation is unique in providing a unified system for recording the progress of paediatric CI users through a system that makes monitoring the child's progress highly accessible.
Conclusions: The outcomes present a meaningful measure, which relates to real world benefits with this complex group of children. Further details on the usefulness of the Champions profile will be presented and discussed.

PP-35

Volume regulation of the inner ear via the V2-receptor/aquaporin-2 system in the endolymphatic sac

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Idiopathic endolymphatic hydrops is the histopathological hallmark of Meniere's disease and other volume regulation related inner ear disorders. From the correlation of elevated levels of antidiuretic hormone (AVP) and the occurrence of endolymphatic hydrops as seen in the clinical observations and the animal experiments, a kidney-like V2-receptor (V2-R) mediated, aquaporine-2 (AQP-2) dependent water regulation system in the saccus endolymphaticus has been postulated. To identify the direct effect of AVP on the endolymphatic sac the molecular basis of such an AVP/ V2-R/ AQP-2 mediated volume regulation system was investigated by immunohistochemical techniques in rat. First, the V2-R and AQP-2 have been detected in wholemount preparations of the saccus endolymphaticus on cellular level. Second AQP-2 could be localized on subcellular level at the basolateral membrane in tissue tec embedded and resin embedded specimen. Third, ADH dependent AQP-2 translocation could be induced by V2-R stimulation and analysed in wholemount preparations and sections. The presence of the V2-R and AQP-2 in the saccus endolymphaticus strongly suggests its functional role in endolymph volume regulation. The experiments might have direct implications for the pharmacological treatment of inner ear diseases associated with idiopathic endolymphatic hydrops.

PP-36

It's all Russian to me: Development of two closed-set Russian speech intelligibility tests that can be administered even by non-Russian audiologists

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Speech audiometry both in quiet and in noise is of major importance for audiological diagnostics. Due to the considerable non-native language effect, a valid speech audiometric outcome can only be achieved if the patient is tested in his or her native language. For testing subjects in their native language, even if the test instructor can not comprehend the subjects' language, a closed-set test format is highly desirable. Since Russian is a major expatriate language all over Europe and no appropriate speech intelligibility test is available in Russian so far, two types of speech in noise tests for Russian have been developed and optimized: a) The matrix type test for diagnostic purposes which contains semantically unpredictable sentences of a fixed syntactical structure, and b) the digit triplet test for hearing screening which uses digit triplets (e.g., 3-5-1, три-пять-один) as speech material. Consecutive steps of the tests development will be presented: selection of the speech material, recordings, optimization, and finally evaluation measurements. For achieving maximum accuracy and efficiency of speech reception threshold (SRT) measurement, a steep slope of the test-specific intelligibility function is mandatory. To increase this steepness by making all speech items as homogeneous in intelligibility as possible, all word-specific intelligibility functions were measured and level adjustments were performed accordingly. Subsequently, evaluation measurements were conducted to verify statistical properties of the optimised speech material. The measured benefit from the test optimisation turned out to be 3.6%/dB for the matrix test and 3.0%/dB for the digit triplet test. Standard deviation between list-specific SRTs for the matrix test and the digit triplet test was 0.2 dB and 0.3 dB, respectively. No statistical differences in SRTs between lists were found. Both types of tests are available on the Oldenburg Measurement Applications platform where comparable tests for currently 10 different languages are implemented as well.

PP-37

Recent advances in SNHL diagnosis from the point of view of radiologist

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Background: Etiopathogenesis of SNHL very often remains unclear and medical therapy is usually indicated only in sudden SNHL with corticosteroids and vasoactive drugs. MRI imaging of inner ear improves the identification of etiopathogenesis of SNHL. Some interesting cases are presented in this paper
Material: Detailed analysis of the algorithm of laboratory, audiology, molecular-genetic tests and imaging are presented. In all patients admitted to our department with SNHL. MRI imaging of inner ear is realized. Case histories of most interesting findings, their management and outcome are presented.
Results: Fibrosis of cochlear canal, intralabyrinthine bleeding, intralabyrinthine inflammation, cochlear fibrosis, tumor in the CPA, dilatation of ductus and saccus endolymphaticus are the findings that can be identified as the reason for SNHL.
Conclusions: The MRI imaging of inner ear should become a standard method in SNHL diagnosis and evaluation. Despite the fact it does not improve the outcome of the management it broadens our knowledge in etiopathogenesis of SNHL and thus may contribute to better management in the future.
This work was supported by the Slovak Research and Development Agency under the contract No. APVV-0148-10.

PP-38

Neural deficits in children with auditory attention dysfunction. Evidence from functional MRI

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Deficits in acoustic discrimination in children with attention dysfunction have been observed in behavioral and electrophysiological studies for years. However, the neural correlate of central auditory dysfunction is poorly understood. Atypical activation of brain network implicated in acoustic attention may underlie behavioral problems. The aim of the presented study is to evaluate this hypothesis.
Subjects: Participants were 7 children with central auditory dysfunction and attention problems (7–16 years) and 10 healthy comparison subjects (22–34 years). Children' diagnoses were confirmed with Central Auditory Processing Disorder Battery. Subjects were studied with functional magnetic resonance imaging at 3T while discriminating tones.
Task Design: The task consisted of 4 blocks of stimuli: 3 attention blocks (frequency block, duration block, intensity block) and one control block, which were repeated 4 times. Within attention block 8 pairs of tones were presented, which differed with either frequency, duration or intensity. Participants were asked to respond by pressing a button with thumb when the same stimulus was repeated twice in a row. In control block participants were presented with fixation cross.
Results: The designed paradigm activates brain regions which are known to be implicated in temporal processing and attention. Group differences in patterns of brain activation were observed in attention ≤control blocks. Adults showed activations in: superior frontal gyrus/superior motor area, anterior insula bilaterally, inferior parietal cortex bilaterally (Broadmann 40), left middle frontal gyrus, right inferior frontal gyrus, superior frontal sylcus bilaterally. The same contrast within children revealed less spatially extensive activation in: superior frontal gyrus/superior motor area bilaterally, left anterior insula, left parietal lobule. While these differences should be interpreted carefully due to small group of participants, nevertheless they seem to disclose an interesting trend: children tend to display smaller and less extensive activation within brain areas implicated in attention. If this trend still shows within a bigger group of subjects, it can suggest that reduced/altered activity in regions implicated in time processing and acoustic attention reflects behavioral attention dysfunction.
Alternatively, differences may reflect developmental differences. These two hypothesis require future research.

PP-39

Biomedical imaging of human Temporary Threshold Shift (TTS) effect

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Background: Research on the phenomenon of auditory temporary threshold shift (TTS) are carried out for many years using various methods of audiometric and electrophysiological measurements. Despite the growing knowledge about the mechanisms of auditory TTS effect, its location and the relationships between stimulus characteristics and TTS characteristics is still debatable question. Exposure of the ear for a long time to noise with a relatively high intensity (above 85 dB SPL) causes not only a decrease in hearing sensitivity (as measured by changes in the traditional threshold of hearing), but also implies the appearance of the tinnitus effect. There is still no answer to the question whether this is a peripheral or central effect.
We also know that there are significant differences in TTS effect after exposure to noise unilateral or bilateral, which is associated with different activity of efferent system with both types of stimulation.

Aim: The aim of this work is to assess the effects of auditory TTS phenomenon at the level of auditory cortex using functional magnetic resonance imaging (fMRI).
Methods: To perform a fMRI study we used a system consisting of: piezoelectric headphones, responsepads, dedicated software to audiometric measurements in the MR scanner and software for the presentation of stimuli. Several volunteers with normal hearing attended the audiometric measurements and fMRI procedure as well. The study was performed on the 3T scanner at the Bioimaging Research Center in Institute of Physiology and Pathology of Hearing. The study design was as follows:
The block design fMRI auditory cortex study, followed by 15 min. narrowband noise exposure with center frequency at 3 kHz (95 dB SPL), then repetition of the fMRI study. SPM analysis was conducted for individuals and for selected regions associated with hearing difficulties – specific regions within the Anatomy Toolbox.
Results: The results allowed us to define functional activation in different parts of the auditory cortex for the fMRI study before and after noise overload. Group analysis shows that activation of primary auditory cortex after acoustic overload was much smaller than before acoustic overload. The effect of TTS at the level of the auditory cortex was statistically significant. FreeSurfer software was used to analyze the results, allowing the precise mapping of activity on the surface of the cerebral cortex.
Conclusions: Statistical analysis showed distinction in activation levels for primary auditory cortex before and after acoustic overload. It was shown that acoustic overload has a significant effect on central nervous system.

PP-40

Psychoacoustic estimation method of basilar membrane compression and temporal integration

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Detection of basilar membrane compression (BMC) has led to a revision of the causes underlying some psychoacoustic phenomena, including phenomena of temporal analysis. Psychoacoustic methods, that used same type of stimuli and maskers for assessment of temporal summation and revealing of BMC, allow us to obtain knowledge in the physiology of hearing in normal and pathological conditions. One such new method assumes measurement of the masking thresholds [Rimskaya-Korsakova, Lalayants, Supin, Tavartkiladze, Acoustical Physics, 2011, 57(1), 106–113]. Noise with a rippled structure of the spectrum and limited frequency band served as maskers. Stimuli had Gaussian-shaped envelope and sinusoidal carrier. Stimuli have been called compact, when its frequency bandwidth coincided with the width of the critical hearing band that appeared at a stimulus spectrum maximum. If central frequencies of stimulus and masker were equal, that masker with central frequency corresponding to the hump of the rippled spectrum, was called an on(rip)-masker while masker with central frequency corresponding to the dip of the rippled spectrum, was called an off(rip)-masker. Frequency of hump (dip) and bandwidth of the masker were 2 and 1 kHz, respectively. Central frequencies of stimuli and maskers were equal to 4 or 6 kHz. Compact stimuli were presented under simultaneous masking. It was measured the dependence of the difference between thresholds of on(rip)- and off(rip)-masking on the masker level. We believed, the dependence has revealed manifestations of BMC. Reducing of bandwidth or increasing of stimulus duration gives us a chance to estimate the temporal summation. Temporal summation of the on(rip)- and off(rip)-masking thresholds with a time constant of around 10 ms was found only in the range of masker mid-levels. In this rang the difference between on(rip)- and off(rip)-masking thresholds of the compact stimuli not linearly depended on the masker level. Masking threshold calculated as difference between stimuli detection thresholds, obtained in presence and absence of masker.

PP-41

The diagnosis of auditory neuropathy in children

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Introduction: As known hearing impairment in children lead psychological and speech abnormalities. Implementation of objective diagnostic methods into practice allowed detecting of hearing impairment since first day of life of a newborn. Thanks to these methods among hearing pathologies found new type of pathology called – auditory neuropathy. In distinction from sensorineural hearing loss, in auditory neuropathy both external and internal hair cells will be functional. Intricacy in diagnosing of auditory neuropathy creates challenges in rehabilitation measures. Etiological factors of auditory neuropathy not fully described yet, though there are several risk factors of development of this pathology as hyperbilirubinemia, hypoxia, low birth weight, infectious diseases and immune disorders.
Objective: To study the frequency and the risk factors of auditory neuropathy.
Methods: The research study carried out in the Otolaryngology department of the second clinic of Tashkent medical academy. The inclusion criteria were children aged from newborns till 12 years olds. Hearing assessment of these children included appropriate objective audiometric diagnostic methods of hearing system as – Tympanometry, acoustic reflex studies, Otoacoustic Emissions (OAE), Auditory Brainstem Responses (ABR), Auditory Steady State Response (ASSR). Examinations were done on the equipment Neuro-Audio (Manufacture NeuroSoft, Russia).
Results: Among children who passed all examination methods, 10% patients accompanied with auditory neuropathy. We reviewed the medical records of the children who had hearing disorders. In order to clarify the etiological factor of hearing impairment in children with auditory neuropathy were done comprehensive analyses of risk factors. The analysis showed that the severe risk factors for auditory neuropathy were hyperbilirubinaemia 49%, low birth weight 53%, preterm infants of gestation ≤37 weeks 78%.
In most cases, auditory neuropathy patients had three or more factors 65% (acceptance ototoxic drugs, existence hearing

impaired family members, infectious disease of mother during pregnancy). In distinction from sensorineural hearing loss only in 13% cases of auditory neuropathy, found existence of single risk factor, but it was as high as 59% in sensoneural hearing impairment.

PP-42

Music induced hearing loss

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Background: With massive growth of enviromental noises, many people putting themselves at risk for hearing loss by listening to loud music specially with portable music players. Our research is relatively cross sectional study and our purpose was to find association between listening to loud music (specially for headphone users) and hearing loss.
We have done Pure tone Audiometry for all of the patients.We tested the frequencies of 250, 500, 1000, 2000, 4000, 8000 and the mean of hearing thresholds was normal (12dB) for all frequencies. Tympanometry was normal type, Acoustic reflex was present.
Methods: All the patients were asked about their habits during listening to music or using headphones.We divided them into two groups based upon loud music listeners (group 1) which include 60 patients, aged (15–30) years old and headphone users (group 2) which include 60 patients, aged (15–30) years old. Hearing evaluation were done for each of them at first visit and after six months.
Patients in group 1 were listeninng to music with average of 2–4 hours per day at 90–120 db and other patients in group 2 were using headphones and frequency usage for this group was three or more times in a week,with an average of 30–150 minutes in each use at 104 db.
Results: We repeated the tests after six months.Examination frequencies at 2000, 4000 and 8000 showed a tendency of being higher than their past for both groups.
The mean of hearing thresholds was increased to 20 db for group 1and 25 for group 2.
Conclusion: As hearing impairment rise among people specially teenagers we approach to a deeper research to find relation between listening to loud music and hearing loss.The results have shown us that loud music can cause damage to hearing and headphone users are suffered more.

PP-43

Ototoxic influence of aminoglycoside antibiotics

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Introduction: In recent years, rapidly growing number of patients suffering from hearing disorders, among large part is sensorineural hearing loss (SHL) in 74% of cases. Most scientists believe that one of the most common causes of SHL is the use of ototoxic antibiotics, destruction of hearing in this case are about 50% of acquired hearing loss of childhood, which makes this problem even more socially significant.
Material and Methods: The second clinic of Tashkent Medical Academy, in ENT department we examined 90 patients with SHL on the basis of admission aminoglycoside antibiotics. Age of patients ranged from 2 to 45 years. From these, in 85 (94.4%) patients SHL emerged after receiving gentamicin sulfate, and in 5 (5,6%) patients after receiving kanamicin. All patients were subjected to complex clinical and audiological examination.
Results: Data of clinical and audiological examination showed different depth of hearing loss, so II degree of hearing loss occurred in 10 patients (11% of cases), III degree in 23 patients (26%), and IV degree of hearing loss was observed in 57 (63%) patients. Analyzing the time and character of the beginning of SHL on these patients we noted the following forms: acute, subacute and chronic. The acute form is characterized by the fact that while taking the antibiotic or shortly after it is for 5-7 days after starting the antibiotic, there is a sudden rapid progressive hearing loss which leading to deafness. The acute form of the SHL was observed in 36 (40%) patients.
Subacute form is characterized by the appearance of hearing loss in 30-40 days after receiving drug, which was observed in 48 (53.3%) patients. The chronic form is characterized by slowly progressive course (during 6 months and more) and leads to a marked degree of high-frequency hearing loss, but deafness does not observed, as was observed in 6 (6.7%) patients.
Conclusions: Thus, when receiving aminoglycoside antibiotics observed the development of the SHL and the degree and character state which depends on the shape of aminoglycoside toxicity. Identified data layouts from our side dictate necessary more in-depth investigation of these patients and the complex approach to treatment and rehabilitation of hearing disorder.

PP-44

Importance of rheoencephalography in sensorineural hearing loss at vascular genesis

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This thesis contains preliminary results of diagnostics of sensorineural hearing loss (SNHL) using rheoencephalography (REG). Early detection of SNHL is particularly critical issue in prognosis and outcome of the disease. The only efficient way of SNHL prevention is reduction of impact and exclusion of disturbing factor, which is however rarely possible. Therefore, at first place comes an early detection of SNHL. Ideally, early detection and differential diagnostics of SNHL of vascular genesis should be specific and as painless as possible. In this respect most perspective are REG records of brain vessels along with audiologic examination. Practically it enables differential diagnostics ranging from hearing loss related to running impulse through nervous structure to damages directly to hair cells. Patients divided to groups were examined; First and basic group consisted of 15 patients with sensorineural hearing loss owing to brains' vascular disorders such as essential hypertension (4 pers.), neurocirculatory dystonia by hypo- and hyper-type (3 and 2 pers. accordingly), osteochondrosis of cervical spine (6 pers.). Second group consisted of 15 patients with sensorineural hearing loss of non-vascular nature. Most notable difference in results of examination of first and second group were received from REG conduction of brain vessels, and this itself became both an increase of tonus in vessels of vertebrobasilar system and decrease of blood supply, which clinically appears along with other neurologic symptoms of hearing loss and ear noise. However, such changes were not observed in REG examination of second group (SNHL of non-vascular genesis). Thus, inclusion of rheoencephalography of brain vessels into the complex of audiological examinations of patients with sensorineural hearing loss with various genesis enables early detection of hearing impairment and differentiation of its various forms, which is itself an important stage in selection of adequate modern method of treatment.

PP-45

Air conduction Ocular Vestibular-Evoked Myogenic Potentials (AC oVEMPs): Diagnostic correlates in peripheral vestibular disorders

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Background: Ocular vestibular-evoked myogenic potentials (oVEMPs) are myogenic potentials that can provide another diagnostic tool for assessing the vestibule-ocular reflex. While many studies concluded that BC oVEMPs predominantly represent utricular function, no conclusions can be made about the AC oVEMPs

Objectives: this research aimed to compare the findings of AC oVEMP versus AC cVEMP in different peripheral vestibular disorders.

Subjects and Methods: Twenty healthy volunteers without previous ear disorders served as a control for AC oVEMP testing. The study group consisted of (25) patients having unilateral peripheral vestibular deficit. Their diagnosis was based on history taking, otological examination and videonystagmography (VNG) findings. All the study group underwent both AC oVEMPs and AC cVEMPs

Results: AC oVEMPs were100% identifiable in all normal subjects (40 ears). Among patients with vestibular neuritis (no.=11), abnormal oVEMPs were found in '85%'(6/7) of patients who had unilateral caloric weakness and in one patient who had normal caloric response. Only two patients had additional cVEMPs abnormalities. All the patients with endolymphatic hydrops (no.=7) had both oVEMPs and cVEMPs abnormalities regardless presence or absence of caloric weakness. While only one patient with benign paroxysmal positional vertigo (BPPV) had abnormal oVEMPs and another had abnormal cVEMPs. In all groups, abnormal oVEMPs responses were in the form of reduced amplitude and /or shift in the absolute latencies or absent response, recorded from contralateral side of lesion. However, bilateral affection was present in (2/7) of affected patients with vestibular neuritis and (3/7) of affected patients with endolymphatic hydrops.

Conclusions: These findings might suggest that AC oVEMPs were correlated with superior vestibular nerve or utricular lesion as an extensive peripheral end organ lesion. AC oVEMPs should be complementary to cVEMPs in the clinical diagnosis of vestibular disorders.

PP-46

Computer audiometry for mathematical biology

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Feature of hearing different people is mixed sounds (tones) perceptions. Effect is caused by noise pollution age development, various pathologies. It leads to a damage risk the hearing organ structures. Basic hearing parameters are established by audiometry.
Purpose: Computerization audiometry for calculations biological parameters hearing on this basis.
Methods: In practice there are difficulties with the use audiometers. The disadvantage of industrial audiometers is the impossibility use arbitrary audio frequency with a given intensity. It's possible to study the hearing organ by using numerous computer sound generators, but they aren't adapted for solving audiometric problems and have little informative. For the realization of the problem we need to create a method, which will use a computer sound generator with the ability to audiometry, measure the frequency maxima perception of sound signals with the sound pressure levels. It would combine the possibility of standard audiometric studies with using new high-tech solutions in bio- and psychophysics of hearing.
Discussion: We develop the computer program with using generator signal audio frequency that allows testing the individual perception frequency range and analyze the hearing quality of a particular person. By creating a program must be taken into account professional medical orientation. The program is created as for the physician otolaryngologist, as well as for any PC user is interested in the status of their own hearing. It includes the organization of a surveys database for the calculation ("non-invasive measurement") the hearing biological parameters (used modern biophysical theory of hearing loss and its clinical applications) and the change dynamics: first – comparison with standard and further – comparison with previous results. The obtained data can create a visual image of the patient's hearing organ and be used to specify the diagnosis and monitor the hearing, which is especially important for professions that are associated with constant sound loads.
Computerization audiometry improves in formativeness parameter estimates hearing and accuracy in monitoring the effectiveness of treatment hearing dysfunction.

PP-48

Follow-up study of patients' satisfaction: A retrospective study of 48 SSD patients wearing a bone anchored hearing aid

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Background: Baha had been used in patients with single sided deafness since about 10 years but according to different studies, speech understanding in noise is thus far limited.
Aim of the Study: In this study, we investigated the subjective outcome of Baha implantation in patients with single sided deafness.
Materials and Methods: 48 patients filled out different questionnaires and sent them back to the hospital. Baha outcome data were obtained with the Dutch version of the APHAB (1), the HHIA-S (2), the Tinnitus Questionnaire and the SSD questionnaire (3). Use of the device was questioned using our own User Survey.
Results: The APHAB shows a significant improvement with the Baha on the subscales EC (37.17 *vs.* 26.33), BN (60 *vs.* 48.67) and RV (58.05 *vs.* 45.05). Hearing handicap lowered significantly from 24.8 to 16.31 (max. 40). the SSD questionnaire demonstrates that the unilaterally deaf Baha user wears his/her Baha meanly 4.8 days a week (SD 2.2) and 2.9 hours a day (SD 1.2). Our User Survey demonstrated that 11% of all patients is very satisfied with the Baha, 37% is satisfied, 45.7% is a little bit satisfied and 5.7% (2 patients) is not satisfied.
If we ask patients if they have made progress since they wear the Baha, 66.7% confirms, 14.3% does not have an opinion and 19% does not think they progressed in any way.
Not enough improvement of speech understanding in background noise is the main disadvantage of the device according to Baha users.
Conclusions: Although the majority of SSD patients are at least a little bit satisfied with their Baha, new technology should focus on improving speech perception in noise. dedicated solutions for this unilaterally deaf group are needed to improve their aided outcome.

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PP-49

Vibration induced nystagmus test in patients with dizziness and normal caloric test

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Introduction: Previous studies have shown that the skull vibration test is sensitive test used to detect vestibular asymmetry between 20 to 150 Hz stimulation. It has been suggested as to be complementary examination to other vestibular tests which evaluate lower frequencies (caloric test, head shaking test, head impulse test). The question arises whether this test might be useable in the evaluation of vestibular function in patient with dizziness with a normal caloric test.
Objectives: To analyze the incidence and characteristics of vibration induced nystagmus in patients with dizziness of probable peripheral origin and normal caloric test results.
Patients and Methods: The prospective analysis of the vibration applied on the mastoid process at 100 Hz during 20 seconds on a sitting upright position in 50 normal subject and in 137 consecutive patients with dizziness suspected of having peripheral vestibular impairment but in whom further investigation have shown normal caloric test. The etiology mainly covered Meniere's disease, otosclerosis, recovered vestibular neuritis. Nystagmus was documented and its corresponding slow phase velocity measured with a 2D videonystagmography system.
Results: The vibration test was positive in 27% of patients with a value of slow phase velocity in between 4.3 and 8.5 degree/s ±4.7 SD and in only 5% of normal subject with a value of slow phase velocity less than 3.1 degree/s ±2.5 SD. In cases in which the pathologic side was possible to determined the direction of vibration induced nystagmus not always correlated with the side of lesion.
Conclusion: The presence and perhaps the value of the slow – phase velocity of vibration induced nystagmus can be used to identify and assess vestibular impairment in some patients with normal (low frequency) caloric test often used as a reference.

PP-50

Skarzynski Partial Deafness Treatment (PDT) Classification

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Aim: According to growing number of different patients with partial deafness our aim was to propose new classification which could cover residual hearing and rehabilitation results.
Material and Methods: In our material there is about 3500 cochlear implant patients. We estimate that with some residual hearing is some hundreds. We divided them into 3 groups: EC, EAS and ES. Each group with clear borders in audiograms with steps 0, 30, 50, 70, 90 [dB] and 125, 250, 500, 1000, 1500, 2000 Hz.
Results: We could easily look for progress in homogenous group of patients. Results are also more clear for patients, what they can achieve.
Conclusions: New classification gives more knowledge about post operative results for patients before surgery and allow to compare results into homogenous group of patients.

PP-51

fMRI as diagnostic tool for patients with indications to Partial Deafness Treatment (PDT)

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Aim: The aim of work was to evaluate nowadays possibility of diagnostic patients with residual hearing by fMRI.
Material and Methods: 25 patients qualified to Partial Deafness Treatment according to Skarzynski PDT classification were diagnosed in Bioimaging Research Center at International Center of Hearing and Speech, Kajetany, Poland. All patients went fMRI procedure with 3T Magnetom TRIO TIsM manufactured by Siemens before cochlear implant surgery. Minimal age 7 years old. Method of analyse – BOLD.
Results: First results have shown decrease activity according to area responsible for receiving appropriate frequency. Also we observed changes on auditory pathway.
Conclusions: fMRI is useful element of diagnostic in patients with some doubt about auditory pathway. We observed decreased signal in appropriate anatomical areas.

PP-52

Partial Deafness Treatment (PDT) patients after heating screening program in schools in Poland

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Aim: Our aim was to evaluate how many schoolchildren have partial deafness according to Skarzynski PDT classification.
Material and Methods: Total number of screened children in age 6–13 years old is 211315. Over 85% of them were on first class of primary school. Screening was made by Sense Examination Platform (device awarded by many gold medals). Test included – pure tonal audiometry, central test (DDT), questionnaires.
Results: Among all results positive results in 6–7 years old is 13.9% (in older average 0.5% more each year). Numer of patients with partial deafness is 0.26% from overall results.
Conclusions: Sense Examination Platform is useful tool for fast, cheap and easy screening examination in schoolchildren. Earlier diagnostic of partial deafness allow to qualify patients for faster and often cheaper treatment.

PP-53

Frequency of mutations in GJB2 gene among patients with other risk factors for hearing loss

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About 60% cases of prelingual HI have genetic background whereas in remaining 40% environmental factors represent the cause. The most common of these are: congenital cytomegaly (CMV) and other inborn infections such as rubella, toxoplasmosis, chicken-pox, syphilis). Also exposure to ototoxic drugs during pregnancy and mother's metabolic disease (diabetes, hypothyroidism, hiperlipidemia, renal failure) are considered important. Another significant group of non genetic risk factors for HI can be perinatal period's incidents such as hypoxia, birth injury, prematurity, low birth weight, hiperbilirubinemia. Postlingwal HI can be also caused ear inflammation, drugs, cranial injury or acoustic trauma.

Whereas these exposures are clearly important in causing HI their relative significance is not known. Our purpose was to assess significance of non-genetic risk factors for HI by analyzing frequency of mutations in GJB2 in a group of 4579 patients classified according to respective exposures. Frequency of GJB2 mutations on both chromosomes was assessed in each group and compared to frequency in a subgroup without any risk factors (971/1370, 24%,). In this analysis low frequency indicates a strong effect of respective factor and vice versa. Preliminary results suggests that rubella (4/104, 4%, ≥0.05) and prematurity (23/243, ≥0.05) are strong reasons of HI whereas effects of congenital cytomegaly and hiperbilirubinemia seem to be negligible. It should also be emphasized that in all analyzed groups we have found some cases of homozygotes for GJB2 mutations indicating that GJB2 linked genetic deafness should always be considered irrespective of occurrence of other established environmental risk factors for HI.

PP-54

Evaluation of mitochondrial DNA heteroplasmy in patients with MELAS disease

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Mitochondrial encephalomyopathy, lactic acidosis and strokelike episodes -MELAS, is one of several mitochondrial diseases. Clinical features also may include: short stature, seizures, episodic vomiting, sensorineural hearing loss and others. Symptom onset can occur protean, also incomplete or milder phenotypes are recognized. We studied 1478 Polish subject recruited from a consecutive cohort of 7000 treated at the Institute of Physiology and Pathology of Hearing between 2000 and 2010. Patients were unrelated and suffered from nonsyndromic, postlingual, bilateral sensorineural HI ranging from mild to profound. All individuals were previously tested for the presence of common GJB2/GJB6 mutations. Searching for the mutation A3243G was performed using different molecular techniques (direct sequencing, RealTime TaqMan Assay, PCR-RFLP, dHPLC).
MELAS mutation was found in 15 unrelated patients. Tests were conducted also in their family members, among whom another 13 cases of MELAS were found.
Molecular tests were performed on DNA samples isolated from blood leukocytes, buccal swabs, hair follicles, urine sediment cells and nails.
In our group of MELAS patients A3243G mutation ratio is significantly higher in urine than in blood and other type of material. Measurement of A3243G mutation ratio in urine is a non-invasive, convenient and rapid method with its diagnostic meaning superior to blood testing. Direct sequencing might not be sufficiently sensitive method for detecting A3243G mutation.

PP-55

Radiological anatomy of frontal recess

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Introduction: Anatomy of frontal recess can be very complex and thereby associated with frontal recess obstruction and chronic frontal sinusitis. The aim of this study is to assess anatomy of the frontal recess in order to investigate if incidence of Kuhn and intersinus septal cells is linked with higher incidence of frontal sinusitis.
Methods: The authors reviewed 100 left and right sides of coronal and sagittal computed tomography (CT) scans of the sinuses obtained from 50 consecutively presenting patients (100 sides) who were being evaluated for frontal sinusitis.
Results: In 29% of analyzed sides no frontal cells were found, but frontal sinusitis was found in 24,14%. Type I frontal cells was found in 33%, type II in 19%, type III in 18% and type IV in 1% of analyzed sides whereof inflammation was found in 45.45%, 52.63%, 33.33% and 100% respectively. Intersinus septal cell was found in 8 patients whereof inflammation occured in 3 of them.
Conclusions: Frontal air cells were indentified in 71% of analyzed sides of frontal recess. Bilateral occurrence of frontal cells was almost six times higher than unilateral, and type I cells were the most common type of frontal cells. The incidence of frontal sinusitis was higher in patients with frontal cells (32%) than in patients without frontal cells (7%). Based on this findings we consider that anatomic variations in the frontal recess play a vital role in frontal sinusitis.
Key words: frontal recess air cells, computed tomography, Kuhn cells, intersinus septal cell

10th European Federation of Audiology Societies (EFAS) Congress

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U-01

Hearing and vestibular organ disorders in patients with systemic lupus erythematosus and systemic sclerosis

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Background: In systemic lupus erythematosus (SLE) and systemic sclerosis (SSc) there may occur hearing and balance disorders as a result of the immune-mediated vasculitis and fibrosis or ototoxic influence of drugs.
Aims: To evaluate the hearing and vestibular organ disorders regarding their prevalence and relationship with duration, type and severity of the disease.
Methods: 35 patients with diagnosed SLE, 20 patients with diagnosed SSc and 30 persons from the control group were enrolled into the study. The laryngological examination was followed by pure-tone, speech, impedance and auditory brainstem response audiometry (ABR). Vestibular examination (spontaneous nystagmus, optokinetic, smooth pursuit, positional tests, kinetic torsion swing test, caloric test) was carried out.
Results. It was found that SLE patients had a significantly poorer mean hearing thresholds than the control group for all frequencies (except for 500; 2000 and 4000 Hz) and SSc patients - only for 500; 1000; 6000 and 8000 Hz. Sensorineural hearing loss was observed in 10 SLE patients (28.6%) and in 8 SSc patients (40%). In ABR, the increasing of average latencies was noted in the group of SLE patients compared with the control and in the group of limited SSc patients compared with the diffuse SSc patients. Significant positive correlation between mean air-conduction hearing thresholds and SLE duration ($r=0.46$; $p\geq0.001$) was found. Furthermore, no relation was seen between hearing level and type and severity of the diseases. On the basis of ENG recordings, vestibular organ lesion was diagnosed in 24 subjects with SLE (70.6 %) and in 14 (70%) with SSc, mostly of the central type – 18 patients (52,9%) with SLE and in 11 subjects (55%) with with SSc
Conclusions: In SLE and SSc similar frequencies of sensorineural hearing loss and vestibular organ lesion, which concerned both peripheral and central types, were diagnosed.

U-02

Positional nystagmus in vertebrobasilar insufficiency

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There are often observed vesibular symptoms in patients with veretbrobasilar insufficiency (VBI).
The aim of the study was to notice the type of positional nystagmus and its origin in this disease.
We divided patients into three groups. The first one (I) was the control group with 20 healthy individuals, women and men, aged as the other two. The second group (II) were patients with central disorders of vestibular system i.e. CNS tumors, multiple sclerosis, epilepsy, menigitis, trauma and toxic injury of CNS. There were 80 individuals 55 (68.7%) women and 25 (31.3%) men aged mean value 53.8 yrs. The third group (III) consisted of 337 individuals, 186 (55.2%) women and 151 (44.8%) men aged mean value 52.3 yrs. There were patients with peripheral disorders of vestibular system in this group. We used VNG measurement to evaluate spontaneus nystagmus (SN), caloric nystagmus (CN) and positional nystagmus (PN).
The type II (using Nylen clasiffication) PN was observed more often in the (II) group – 66.7% of all cases. The type III PN was observed (more often) in the (III) group – 47.2% of all cases. The amplitude and the latency time of PN were statistically greater in the (II) group compared with the (III) group. The canal paresis was observed in the 77.5% of all cases in the (II) group and in 38.5% of all cases in the (III) group.
Positional nystagmus (PN) origin in vertebrobasilar insufficiency (VBI) was observed mainly in ischemic structures of vestibular system in its peripheral part. This conclusion was created in conection with presence and quality of canal paresis and quantity parameters of positional nystagmus.

U-03

Vestibular system in patients after mild head trauma

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Introduction: Vertigo, dizziness and balance disturbances are common complaints in patients after mild head trauma.
The Aim of this study was to evaluate the complaints and type of vestibular system impairment in patients after head trauma in relation to the onset and duration of their complaints.
Material and Methods: The study was conducted on 36 consecutive patients with disequilibrium, after head trauma at different onset period (mean age 46.3±8.19 years), diagnosed in ENT Department Medical University of Lodz. The anamnesis was taken

in the form of a questionnaire. The control group comprised 40 healthy persons (mean age 47.8±9.8 years). In all subjects the laryngological examination with Hallpike'a maneuver, static and dynamic balance tests were performed. VNG (Ulmer, Synapsys) examination with saccade, smooth pursuit, optokinetic, positional, kinetic and caloric by Hallpike's method tests was performed in all cases.
Results: In 5 patients benign paroxysmal positioning vertigo was diagnosed. From remaining 31 patients 58% reported momentary lost of consciousness, 42% vertigo, 58% dizziness, 45.2% headache, 12% unsteadiness, 16.1% memory problems. In 80.7% patients signs of vestibular system impairment were recorded. The central signs were observed in 45.2%, peripheral in 25.8% and both in 9.7% patients. Abnormal VNG outcome was significantly more often recorded in patients after head trauma in all tests. Detailed quantitative statistical analysis showed differences in saccade test parameters (latency, maximal velocity and accuracy), mean gain value in smooth pursuit test and optokinetic asymmetry between posttraumatic patients and control group.
Conclusions: The study emphasized that VNG examination are able to detect vestibular dysfunction in most of the patients after mild head trauma and may justify so common complaints in this group.

U-04

Vestibular disorders in arterial hypertensy patients

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Dizziness, tinnitus and vertigo are common signs observed in arterial hypertensy.
The aim of the study was to evaluate functional condition of vestibular system in connection with retinal changes in this disease. We divided patients into three groups. The first (I) group consisted of 41 individuals 26 (63.4%) women and 15 (34.6%) men aged mean value 56.3 yrs with arterial hypertension lasted for 8 to 10 yrs and none retinal changes. The second (II) group with 55 individuals 26 (47.3%) women and 29 (52.7%) men aged mean value 61.4 yrs with arterial hypertension lasted for 8 to 12 yrs and retinal changes stage one and two (Keith-Wagener-Barker classification). The third (III) group was the control group with 20 healthy individuals (women and men) aged as in the (I) and (II) groups. All patients underwent special test including: otoacustic emissions (OAE), brainstem auditory evoked potentials (BAEP), craniocorpography (CCG), vestibular evoked myogenic potentials (VEMP) and videonystagmography (VNG).
There were none differences in presence of dizziness and vertigo between the (I) and (II) groups. Similalry we observed no differences between the (I) and (II) groups according to hearing level and presence of tinnitus. But there were disorders in OAE tests and (statistically more often) disorders in CCG tests (gaze nystagmus, eye-tracking movement, optokinetic nystagmus (OKN)) and VEMP tests in the (II) group.
In conclusions we may say that in arterial hypertension patients damage can be seen in membranous labyrinth and brainstem. These results are statistically more often in patients with retinal changes.

U-05

Neuronal systems and processes engaged during active frequency discrimination task evaluated using simultaneous AEP-fMRI recordings

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Introduction: Neuronal mechanisms and systems on the cortical level associated with sound frequency discrimination are still not well known. They base on quickly occurring processes which can not be monitored separately using only the fMRI technique. Simultaneous recordings of auditory evoked potentials and functional magnetic resonance imaging (AEP-fMRI) is a new neuroimaging method with good temporal and spatial resolution. It gives a chance to describe neuronal processes connected with higher auditory function precisely both in time and space domain.
The Aim of the Study: was to investigate the cortical neuronal processes engaged in the process of discrimination of tones at normal hearing adults.
Material and Methods: Five healthy adult volunteers, participated in the experiment. They were discriminating similar frequency tones which were presented in separated blocks as the standards and deviants stimuli using the odd-ball procedure. Auditory evoked potentials generated in responses to tones were recorded using 64-channel electrophysiological system. fMRI data acquired simultaneously with AEP were registered in continuous mode using high-fielded (3T) MR scanner. Dipole source analysis was applied for modeling the bioelectrical generators auditory evoked potentials to presented stimuli. The modeled dipoles of AEP were overlapped and integrated with the fMRI activations.
Results: Analysis of electrophysiological data showed that the standard stimuli generated auditory evoked potentials with N1 and P2 waves. The same exogenous components were also present in the AEP to deviant stimuli but they additionally contained P3 waves. Analysis of fMRI data revealed that the discrimination between standard and deviant tones activated mainly frontal and parietal regions associated with continuous attention and executive functions. However, when the deviant tones were distinguished from standard stimuli there were active only in frontal lobe responsible for executive functions and associated with working memory. During deviants differentiation task the activation around the auditory association cortex was also observed. fMRI activations in auditory cortex corresponded with the modeled generators of AEP to deviant tones at range 180–220 ms. Regions in parietal lobes activated during discrimination of standard tones overlapped with the localizations of AEP dipoles to deviant tones modeled in P3 wave latency range. The presence of the AEP dipoles to deviant tones modeled in the range of P3 wave corresponded with the attenuation of parietal and frontal activity which were observed during the standard stimuli discrimination.

Conclusions: Active discrimination of different frequency tones engages different cortical cognitive processes and neural systems.

U-06

The auditory steady-state responses (ASSR), auditory brainstem responses (ABR) and behavioral audiometry in threshold estimation of adults with sensorineural hearing loss

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Background: The need for an objective tool to efficiently predict the audiogram caused that the use and importance of ASSR method is growing in recent times. This is quite a new method of electrophysiological threshold estimation and it needs to be still improved.
Aim: The aim of this study was the comparison of auditory thresholds estimated by ASSR with those obtained by ABR (click and tone-burst) and pure tone audiometry (PTA) in adults with sensorineural hearing impairment.
Methods: We tested 83 ears (52 woman and 31 men, mean age – 49.1±15.8 yrs) which were assigned to different groups of hearing loss based on their pure-tone audiometry threshold (normal, mild, moderate, severe and profound). Four commonly used frequencies (500 Hz, 1000 Hz, 2000 Hz, 4000 Hz) were evaluated with pure-tone audiometry, ABR (click and tone bursts 500 Hz and 1000 Hz) and ASSR (Navigator Pro, MASTER). Differences and correlations between the ASSRs, ABRs and the audiometry thresholds were determined.
Results: It was found that the mean values of pure-tone audiograms, ASSRs and ABRs thresholds did not differ significantly across all frequencies only in profound hearing loss. The differencies between average threshold values in the whole group were coincident for 2000 and 4000 Hz (PTA-ABR, p=0.37 and 0,6) with tendency for 1000 Hz (ASSR-ABR, p~0.06). For the whole group of patients there were high (Pearson correlation coefficient r≤0.9) and significant (p≥0.001) correlations between all methods (PTA-ASSR: 0.92–0.95, PTA-ABR 0.93–0.98, ASSR-ABR 0.91-0.92). The correlations between pure-tone audiometry and ASSR were better for higher degrees of hearing loss (e.g. r values for tested frequencies in mild hearing loss were 0.24, 0.42, 0.72, 0.79 and for profound hearing loss 0.78, 0.64, 0.81, 0.81; respectively). The best correlations between all methods we observed for 2000 and 4000 Hz.
Conclusions: The results of the study point out that ASSR technique may be useful method in assessing of threshold in adults for higher degrees of hearing loss, but ABR test still remains the most accurate electrophysiological method in hearing threshold evaluation.

U-07

Response characteristic of the simultaneously recorded 80 Hz ASSRs and ABR/MLR for threshold detection

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Background: Hearing threshold detection with ASSRs typically use objective statistics based response detection with little electrophysiological waveform information. Interpretation of such response does not provide enough information about underlying hearing problem. Since the ABR/MLR response cannot be extracted from the ASSR's recordings we propose to use low-jitter steady state responses (QASSRs) which have similar time-frequency characteristics at the stimulation frequency (f0) and the first harmonic (f1) as the real ASSRs. Using slightly jittered 80 Hz stimulation sequences, QASSRs elicited by AM modulated sounds can be recorded and deconvolved to obtain ASSRs and ABR/MLR from the same recording.
Aims: In this study, the simultaneously recorded auditory quasi steady-state responses (QASSRs) and ABR/MLRs were investigated using continuous loop averaging deconvolution (CLAD) algorithm for hearing threshold evaluation.
Methods: Two-channel (ipsi and contralateral earlobe reference and vertex) QASSR were recorded with trains of 78.13 Hz jittered tone bursts (500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz) presented monaurally and deconvolved for ABR/MLR acquisition with CLAD algorithm. Response phasors at 78.13 Hz and 156.26 Hz were analyzed in the complex domain and Hotelling's T-square statistic were used to determine hearing thresholds using confidence intervals (p≥0.05).
Results: Phasor analysis data provided good prediction of the audiometric thresholds with high accuracy (within 5 dB) and quantitative data on response magnitude and apparent latency. Additionally ABR data from the same recordings provided further visual response verification. Comparison between commonly used ASSRs and ASSRs derived from QASSRs recordings was also performed to verify their similarity.
Conclusions: The QASSR/ABR/MLR method provided accurate and reliable estimation of behavioral thresholds in adults with normal hearing.

U-08

Perinatal asphyxia –influence on hearing organ and central nervous system

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Perinatal asphyxia may cause many systemic side effects, central nervous system (CNS) as well as hearing organ are quite vulnerable to anoxia. The consequences range from reversible to irreversible changes in the cochlea, brainstem or cortex causing sensorineural hearing impairment and various degrees of neurodevelopmental deficits.
The aim of the study was to carry out the objective assessment of the hearing organ activity using CEOAEs and ABR in infants with CNS impairment occurring as an effect of perinatal asphyxia; to find any relationships between hearing status and parameters describing hypoxia.
To the investigation (InvG) 36 neonates with hypoxic-ischemic encephalopathy, periventricular leukomalacia or intraventricular hemorrhage imaged during trans-fontanel ultrasonography were included. The control group (CG) encompassed 32 health children matched as to the age. In all infants in 3rd month of life otoscopic examination, CEOAEs and ABR with stimulation levels 85, 80, 60, 50, 40, 30, 20 dB nHL were performed. Perinatal anamnesis, general pediatric status, results of trans-fontanel ultrasonography and biochemical test results were taken into account in statistical analyses.
The mean amplitudes of CEOAEs in 3rd month of life were reduced in InvG comparing to control babies. The analysis of CEOAEs response in half-octave frequency bandwidth (HOFBW) revealed significant reduction in InvG for 1.5–3 kHz (≥0.05). No differences were found between latencies of waves I and II. ABR latencies of waves III, IV, V and interpeak latencies (IPL) I–III, III–V, I–V were delayed in InvG when compared to control patients. The statistical analysis showed positive correlation between latecies of waves I, III and pCO_2, between IPL III–V and artificial ventilation as well as negative correlation between IPL III–V and gestational age, and chest circumference of neonate.
Conclusions: The central auditory pathway is less mature than the peripheral auditory structures in neonates after perinatal aphyxia. Brainstem is more vulnerable to risk factors connected with hypoxia than cochlea.

U-09

Deconvolved transtympanal electrocochleography obtained at high stimulus rates in patients with acoustic tumor

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Problem Addressed: To investigate a new strategy of deconvolution of auditory evoked responses recorded at high stimulation rates in patients with cerebello-pontine angle tumors (CPATs).
Methods and Measures: Twenty five patients with CPAT and ten healthy young subjects was tested using a strategy of evaluation of the auditory system using "Continuous Loop Averaging Deconvolution" technique (CLAD). Details of technical and software issues were published (Delgado & Ozdamar, JASA 2004; Ozdamar & Bohorquez, JASA 2006). In all subjects presurgery auditory responses were recorded in option of transtympanal electrocochleography (TT-ECochG). Ears were stimulated by click (85 dB nHL) presented at rates ranging from 58/sec to 780/sec in CALD strategy. Recorded data let recognizing action potential (AP) and summating potential (SP). SP/AP ratio and function of AP changes in relation to stimulus rate with "critical point" ("CP") of this reduction was analyzed. "CP" was defined as a stimulus rate value at which fast AP reduction passes into slow reduction.
Results: In all cases within stimulus rate increase AP was systematically reduced with simultaneously maintained or slightly reduced SP. Three patterns of AP reduction in relation to stimulus rates were observed: "pattern A", "pattern B", and "pattern C"(details described in accompanying abstract). In healthy subjects pattern A was observed. In patients with acoustic tumor pattern C was observed in majority of cases. Also in ABR latency of wave III and V was observed with rate stimulation increase. All CLAD results were correlated with tumor size and its localization as well as with other audiological test results.
Conclusions: CLAD technique provides a valuable an important information about auditory system and precisely defines degree of damage of peripheral auditory system in patients with acoustic tumor. CALD strategy significantly supports traditional audiological test battery in diagnostic process of hearing organ status.

U-10

Audiological Factors predicting postoperative hearing following acoustic tumor resection

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Objective: To develop an effective model of prediction of postoperative hearing results following cerebello-pontine angle tumor (CPAT) surgery using transtympanal electrocochleography (TT-ECochG) and auditory brainstem responses (ABR) measured intraoperatively.
Study Design: A prospective study of 31 patients undergoing CPAT surgery in whom hearing was monitored intraoperatively and a model of prediction of postoperative hearing was developed.
Setting: This study was performed in a tertiary referral center.
Subjects and Methods: Thirty one patients with CPAT were operated using middle fossa approach. Pure tone average (PTA) from 0.5-, 1.0-, and 2.0-kHz were calculated pre- and post-operatively (pre-op, post-op). TT-EcochG needed 64–256 sweeps for effective (intraoperative monitoring) IM while ABR 512-1024 sweeps. A specially developed by the authors software analyzed and collected all data on-line. The following parameters were recorded intraoperatively: ABR-Wave-V latency, compound action potential amplitude (CAP-Amp) and latency (CAP-Lat).
Results: CAP-Amp, CAP-Lat and ABR wave V were on-line visualized. Repeatable CAPs were always recorded while ABR wave-V relatively often disappeared or morphology changes did not let to establish easily automatic analysis. To average and visualize CAP-Amp and CAP-Lat 4–6 seconds were needed, while ABR consumed usually 20–30 sec. Introperative changes of CAP-Amp and CAP-Lat corresponded faster and more sensitive to various introperative situations than ABR. The Spearman Correlation Test revealed that preoperative PTA, prolongation of post-op CAP-Lat, ABR-Wave-V, and ABR I-V inter-latency value as well as CAP-Amplitude reduction perfectly correlated with post-op PTA (R ranged from 0.48 to 0.51; $p \geq 0.005$).
Conclusions: Some parameters of ABR and TT-EcochG measured during IM of hearing let to develop an effective model of prediction of postoperative hearing with no special time consuming procedure.

U-11

Click and tone burst evoked otoacoustic emissions in subjects with hearing loss above 0.5 and 1 kHz

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Aims: Presence of otoacoustic emissions (OAEs) in subjects with high frequency hearing loss was investigated by measurements with click and tone burst stimuli.
Methods: Subjects with impaired hearing were divided into two groups. The first group with hearing loss above 0.5 kHz and the second with loss above 1 kHz. Additionally, all measurements were performed on control group consisting of normally hearing subjects. Clicks, 0.5 and 1 kHz tone bursts were used to evoke transiently evoked otoacoustic emissions. Each subject was also tested for the presence of spontaneous OAEs. Otoacoustic emissions were analyzed in half-octave bands in the 0.5–4 kHz range. The analyses were focused on detection of responses in the low frequency region. The presence of OAE was evaluated by reproducibility parameter. It is defined as the correlation between two buffers of sub-averages of single responses.
Results: The reproducibility of responses to clicks for 0.5 kHz group was very low, meaning that these stimuli did not produce OAEs. On the other hand reproducibility for responses to tone bursts was only slightly lower than that of normal subjects.
Conclusions: Tone burst evoked OAE is more reliable than click evoked OAE in the case of activity in the low frequencies. However, the reproducibility values for low frequency responses of normally hearing subjects are usually significantly lower when compared to standard wideband click stimuli. Therefore, the prolongation of measurement and/or lowering detection criteria should be considered for tone burst evoked OAEs. Nevertheless, the 0.5 and 1 kHz tone bursts could be a promising tool for detection of emissions in patients with deep high frequency hearing loss when click stimuli did not produce OAE.

U-12

An assessment of the bilateral otoacoustic emissions tests

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Otoacoustic emissions, described for the first time by Prof. D. Kemp in 1978, have since been a subject of clinical and experimental studies. Until recently, OAEs were regarded as an innovative method, but now they are routinely used in audiological diagnostics. So far OAEs were measured by applying unilateral test (i.e. using one probe to test one ear at a time). There is lack

of published data on the use of two-probe OAE measurement apparatus that allows bilateral testing (both ears at the same time). The main aim of the study was the evaluation of OAEs measurement method in bilateral test.
Two sets of OAEs measurement were compared: unilateral and bilateral tests. The repeatability of both methods was also investigated. 81 normal hearing adult volunteers participated in test. Click evoked otoacoustic emissions (CEOAE) and distortion product otoacoustic emissions (DPOAE) recordings were performed on the right and left ears unilaterally and then bilaterally. After a few minutes the second recording – retest was performed. Analysis of the results confirmed the similar level of DPOAE response in bilateral and unilateral tests. However, the higher level of CEOAE response was observed in bilateral test. Both of tests had good repeatability and low value of intercorrelation coefficient, so both can be used equivalently.
Bilateral test takes less time to conduct and both ears are tested in the same acoustic conditions, so it has an advantage over unilateral test. It can be used in neonatal screening tests, where shorter time of testing is especially important. It allows better utilization of equipment and working time staff. Moreover, binaural test brings a new quality for scientific research of hearing physiology, especially for medial olivocochlear system testing.

U-13

Comparison of three ABR-based methods in diagnosis of retrocochlear hearing loss – preliminary results

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The purpose of this study was to compare results of three different ABR-based methods in detection of retrochochlear impairments in the group of patients with retrocochlear hearing loss. The group of subjects examined included patients with suspected acoustic neuroma, cerebello-pontine angle tumors and neuro-vascular conflict. Three different methods of eliciting ABRs were used: the standard click-ABR method, Stacked ABR (by M. Don) and the ABR Tone method (by K. Kochanek). The control group consisted of normal-hearing volunteers. Besides of ABR examination, each person was subjected to MRI examination with gadolinium contrast in a scanner of 3T main-field flux density. The results of ABR tests, similarly as the results of MRI examinations, were assessed independently by three experts of long-term experience in each of these methods. The work presents preliminary results of the investigations in subjects representing different clinical cases of the mentioned impairments.

U-15

Acoustic analysis of voice after cordectomy

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Aim of the Study: Objective estimation of acoustic voice parameters in patients after laser cordectomy for stage T1 and stage T2 laryngeal carcinoma over a 13-year follow-up period.
Material and Methods: Acoustic analysis was performed in 58 males who underwent a laser cordectomy. An analyzing program 'IRIS for Phoniatrics was used. The effect of cordectomy on acoustic parameters was studied. A correlation between both the extent of the procedure and a particular follow-up period, and acoustic parameter values was determined.
Results: In the majority of cases, a markedly higher basal frequency related to scar tension and a tendency to hyperfunction were observed. F0 was lower in longer follow-up periods. A speech sound was characterized by a rich frequency spectrum and appropriate formant structure. In the majority of the parameters, a clearly marked tendency for the values to improve with longer follow-up periods was observed. For some parameters, the change was statistically significant. We also noted a large content of unharmonic, low-frequency components, including the subharmonic components with frequencies of 0.5 F0 value.
Conclusions: The acoustic analysis revealed the existence of a double vibrating mechanism, which clinically corresponds to vibrations produced by the scar and a healthy vocal fold. The analysis of acoustic parameters confirmed correlation between the quality of voice and the extent of neoplastic spread and also showed improvement in longer follow-up periods.

U-16

A case of Wegener granulomatosis of the larynx

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A case of Wegener granulomatosis of an extremely rare localization within the vocal fold is presented. A 45 years old man was diagnosed in the Department of Rheumatology due to suspected autoimmunological disease. Diagnosis of Wegener granulomatosis based on the clinical manifestations, immunological and histopathological examinations. Hoarseness developed together with the muscular manifestations. A deep defect of mucosa, about 6 mm long within the middle part of the left vocal fold was confirmed during laryngovideostroboscopy examination. A

typical treatment consisted of steroids and endoxan was instituted. Within two months remission of clinical and laboratory manifestations was observed. The control laryngovideostroboscopy examination revealed the left vocal fold of smooth edge and surface within the whole length. Mucosal wave was normal, complete glottal closure was observed. Voice was clear and resonant. A patient is still under observation and control of Rheumatology and Phoniatric Departments.

U-17

Mel cepstral analysis of voice in patients with vocal nodules

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Background: It has been shown that acoustic analysis could be a valuable objective tool for diagnosing of dysphonia. Recently, the special regard is forwarded to mel cepstral domain, which is obtained by transforming nonlinearly both the frequency scale and the Fourier coefficients of the analysed voice signals.
Aim: The aim of this study was to assess the applicability of Mel Frequency Cepstral Coefficients (MFCC) in acoustic analysis for diagnosing of vocal nodules.
Material and Methods: The study comprised 40 female controls with normal voice and 40 female teachers with nodules confirmed by laryngovideostroboscopy. The teachers were from 25 to 53 years old (mean age 41 years). The mean age of the control group was similar: 43 ranging from 23 to 58 years. The acoustic testing involved recording sustained vowels 'a' and four standarized sentences. The voice samples were analyzed by computed analysis of MFCCs in which the Sammon projection was employed for data dimensionality reduction and the Support Vector Machines for data classification.
Results: The comparison of MFCC results revealed significant differences between study group with vocal nodules and controls. The following diagnostic test performances for patients with vocal nodules were obtained:1) for the sustained vowel: 72% sensitivity and 70 % specificity, 2) for the standardized sentences (averaged for 4 sentences): 87% sensitivity and 90% specificity. The results presented better accuracies for the standardized sentences. This is in agreement with recent findings that continuous speech provides richer information about harmonic disorders in comparison to sustained utterances of vowels.
Conclusions: The mel cepstral-based analysis of the voice samples can be a promising tool for estimation of harmonic disturbances in pathological voices. However, further studies on larger groups of subjects with voice disorders are required to confirm these findings.

U-18

Quality of voice in patients after hyaluronic acid injection into vocal folds

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Introduction: Method of vocal folds implantation with allogenic materials has been applied in medical center allover the world for over 30 years. This voice improving method is usually applied in several indications such as: presbyphonia, single sided paralysis of vocal folds, glottis insufficiency, vocal fold scars or sulcus vocalis. All of these illnesses prevent the patients to obtain full glottis closure and produce good quality voice.
Aim: To assess quality of voice after implantation of hyaluronic acid to the volcal folds.
Material: Consisted of 15 patients, who underwent surgical implantation of hyaluronic acid to the vocal folds. 10 patients had the procedure performer on both sides of the larynx, this group included 6 patients with vocal incapacity of the glottis, 2 with scars and atrophy of the vocal folds and 2 with presbyphonia. In 5 cases the hyaluronic acid was applied on one side of the larynx. The gropu included 4 patients with single sided paralysis of vocal folds and one person with single sided scars and atrophy of the ocal fold.
Method: Each patient was examined with videostroboscopy, videokymography and underwent objective and subjetive assessment of voice.
Hyaluronic acid was injected surgically with Jet Ventilation general anesthesia. In two cases during the procedure scars were removed from the vocal folds.
All patients after hyaluronic acid augmentation took part in the rehabilitation program that is realized in the Audiology and Phoniatrics Clinic of the IFPS. The rehabilitation included sereies of voice emission exercises before operation and 3 months after the procedure.
Examination were performed 1, 3 and 6 months after injection.
Results: In all cases improvement of quality of voice was obtained which was stated by a physician and the patients subjectively. Improvement of harmonic voice structure was confirmed by spectrographic record, hoarseness was decreased in Yanagihara scale either.
Acoustic examinations revealed that the improvement was obtained within parameters describing amplitude disturbance and noise existence.
Three months after operations videokymographic images of the larynx were improved, further stabilisation was observed in the next three months.
Decrease of value of the open quotient and increase of closed quotient was obtained within 6 months after injection of hyaluronic acid.
Conlusions: 1. Injection of the hyaluronic acid to the vocal folds is an effective method improving quality of produced voice. 2. Clinically significant voice improvement after hyaluronic acid injection can be obtained after 3 months after the procedure, within the next months voice becomes stabile. 3. Values

of the open quotient and closed quotient in the videokymographic examination allow to objectively assess phonation closure improvement.

U-19

Comparison of certain personality characteristics of the teachers with voice disorders with outcomes in emotional subscales Voicehandicap Index VHI

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Voice by Brodnitz is not only verbal communication tool but also a reflection of feelings, emotions, thoughts and experiences of man

The Aim of our work was to find correlation between personality features (Eyseneck test) of examinee teachers and voice self assessment in Jacobson's VHI scale and to proof it statistically.

Material: Consisted two groups of patients, first – 50 teachers aged 35–60 years with complains of voice disorders and control group of 20 persons aged 30–45 years teachers without voice problems. The working period as a teacher was lasted from 10 to 30 years (medium 13). The investigated group was divided in 2 subgroups of functional and oranic voice disorders.

Methods: Contains phoniatric examination of larynx phonation function, personality estimation in Eyseneck test and voice self-assessment evaluation in VHI.

Results: Showed statistical significant difference in Eyseneck subtests (laying and neurotism) only between teachers with functional voice disorders and control group. Similar results were noticed in emotional subscale in VHI in the same group of patients-with functional voice problems and control group. There was no such a correlation between patients with organic voice disorders.

Conclusions: The Eyseneck personality test and particularly neurotism investigation subscale is not very useful in a group of teachers with functional voice disorders- the most common patients in phoniatric everyday practice, because of very high level of aggravation tendency in laying subscale in this group.

U-20

Voice estimation in patients after chordectomy due to larynx carcinoma

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Treatment of laryngeal cancers, one of the most common types of head and neck cancer, may include surgery, radiotherapy, chemotherapy, or a combination. For many years total laryngectomy (TL) has been the standard surgical treatment. Today we have much more possibilities of operation techniques which we can offer to patients, but of course the type of operation depends on stage of carcinoma. Chordectomy is one of the opportunities for the patients. This technique can preserve the main laryngeal functions the respiration, phonation and swallowing. The investigation was carried out on a group of 24 patients aged 52–81 years (mean 64.7), consisting of 2 female and 22 male patients, who underwent surgery due to laryngeal carcinoma. The methods used in our investigation based on (1) videolaryngostroboscopy of the neoglottis, (2) acoustic voice analysis by the Kay technique, (3) aerodynamic measure- maximum phonation time (MPT), and (4) voice self-assessment on the VHI scale. The results showed different quality of voice, mostly depending on type of neoglottis and rehabilitation process.

U-21

Cochlear implant as an important factor of the development of prosodic features of speech in children with prelingual deafness

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Profound prelingual hearing impairment has a substantial influence on child development, particulary on their ability of linguistic communication. Language plays a leading role in human communication. In lingual communication, the prosodic features play the basic role because they are responsible for proper speech reception. The prosodic aspects of speech is disturbed in people with hearing disability and involved with communication deficit. Cochlear implantation has become a method that reinforced of appropriate language development in children with prelingual deafness. Majority of the young cochlear users can to develop substantial language skills. However, whetehr those children do also develop communication skills such as the prosodic aspects of the language, remains an open problem. The objective of this research was give the answer to this question.

U-24

Paroxysmal tinnitus after cochlear implantation

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Paroxysmal tinnitus after cochlear implantation is a rare symptom.
Aim: to present a case of 46 years old woman with suffering paroxysmal tinnitus 10 months after cochlear implantation at implanted side. Attacs were observed several times during a week, without any noticed cause, lasting 3-4 hours, disappeared spontaneously.
Methods: A patient was admitted to our Department serveral times during 2 months. Audiological, electrophysiologiacal tests as well as specialist consultations were performed.
Results: Diagnostic imaging (CT head and ears) do not revealed any pathology. Some pathological recordings wers noted during EEG test. SPECT examination reveaed increased activity of auditory cortex. After neurological examination treament against epilepsy was introduced. Drug concentration within blood was monitored. There was no attact observed during last 5 months since treatment was introduced.
Conclusions: Sudden paroxysmal tinnitus can be an audiological symptom of epilepsy.

U-25

Program of Audiological Qualification for sequential bilateral implantation in children

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Aim: The CI program in Poznan started in 1994 and includes 770 Nucleus devices. We prepare to gain our experience with bilateral sequential implantation (BSCI).
Material and Methods: Two groups of our implanted children was selected for potential second device implantation. First group included children implanted with first CI within last year up to 7 years of age. The second group included children implanted within last 3 years at the age till 18 months.
Results: Meeting with parents of implanted children was organized to inform about the the state-of-art on BSCI. Parents of 8 children decided to participate in the study. Evaluation were done by two teams: by audiological team responsible for qualification working with children before surgery and by rehabilitation team working with children after surgery.
Conclusions: As we wait for financial support for bilateral implantation study we prepared our protocol and program of selecting children for BSCI.

U-26

Acceptable noise level as a measure of the quality of hearing aid adjustment

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Acceptable noise level ANLfitt is calculated as a difference between the level of maximum comfort of speech perception in silence (MCL) and the level of multi-talker speech babble as the competing background noise (BNL) at which person with hearing loss in free field conditions is able to follow the narration without symptoms of tension or fatigue. The magnitude of ANLfitt can be determined with or without the hearing aid, which permits determination of (ANLfitt). The quality of hearing aid adjustment measured by the acceptable noise level was verified with direct measurements of the speech intelligibility, APHAB procedure and shift of the threshold of hearing loss in free acoustic field.
The study has shown that the change of speech intelligibility (ZM) obtained from the APHAB procedure is greater or equal 20% for (ANLfitt) greater or equal to 2 dB. The measurement of the acceptable noise level is easy, so it is recommendable as a future commonly used method for assessment of the quality of a hearing aid adjustment. In contrast to the measurements of speech intelligibility and shift of the hearing loss threshold, which are work and time consuming, the ANLfitt measuring procedure proposed takes 5 minutes and is very easy for the patient.
The study should be performed not only for the long time hearing aid users but also for the persons who have never used a hearing aid before. The latter can give more objective response as they are not used to the adjustment of the previously used hearing aid or to certain procedures of adjustment.

U-27

Genotype-phenotype correlation of patients with hearing loss carrying the 3243A>G mutation in mtDNA

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Background: Patients harbouring the 3,243A≤G mutation in tRNA leucine (UUR) gene (MTTL 1) frequently develop multisystemic disease, however they may present an isolated sensorineural hearing loss (SNHL).
Aim: To compare clinical manifestation and audiological parameters of patients carrying the 3,243A≤G mutation with a heteroplasmy level of the mutation in examined tissues.

Methods: We analysed DNA samples from: blood leukocytes, hair follicles, urinary sediments, buccal mucosa and nails of 32 patients (16 probands) carrying the 3,243A≤G mutation.
Molecular search for the 3,243A≤G mutation was performed on RealTime PCR using TaqMan Assay; a heteroplasmy level was assessed using PCR-RFLP analysis.
Results: Among 16 nonsyndromic patients (11 women), aged from 6 to 62 yrs; mean age 19 yrs we frequently observed postlingual, stable SNHL.
17 syndromic patients (10 women) aged from 12 to 75 yrs; mean age 39 yrs: poslingual progressive SNHL or retrocochlear hearing loss was encountered.
Patients from this group present myopathy (n=10), diabetes mellitus (n=5), peripheral neuropathy (n=5), migraine (n=5), ophthalmologic disturbances (n=5), cardiomyopathy (n=4), infertility (n=4), MELAS syndrome (n=5).
Heteroplasmy level of the mutation correspond with general status of each patient; the higest value was observed in urinary sediment.
Conclusions: Patients with postlingual isolated SNHL demonstrating maternal inheritance require a diagnosis for the 3243A≤G mutation. Progressive postlingual SNHL in syndromic patients seems to be a good phenotypic marker of mitochondrial disorder. Analysis of a heteroplasmy level of mtDNA mutation is important for a diagnostic process.

U-28

Large deletion/insertion in GJB6/GJB2 genes in the pathogenesis of genetically related hearing loss

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Isolated hearing loss is the most common, congenital defect of the human senses, which affect from 1 to 2 children per thousand. Such hearing loss is in most cases caused by mutations in the GJB2 gene among which most frequent is 35delG. In the Polish population exist a large group of patients with unexplained hearing loss, presumably associated with undetectable, interoperable with 35delG mutations in GJB2 or GJB6 genes. In such group of patients the presence of genetic pathogenic changes, other types than point mutations, small deletions or insertion can be considered, for example large deletions or insertion. Changes of this type may be responsible for the occurrence of hearing loss among patients with unexplained pathogenesis. The aim of our study was to search for large deletion/insertion in GJB6/GJB2 genes.
Analyses were conducted using Real Time PCR absolute quantification. The difference between the Ct value of GJB6 and reference FLG gene was analyzed. Analyses were carried out in the presence of control samples with deletion of the gene GJB6 D13S1830. Double Real Time PCR reaction (GJB6 and FLG gene amplifying) for 184 samples with genotype 35delG/wt, and 430 double Real Time PCR samples - 35delG homozygotes were performed. Difference in Ct values were calculated for all analyzed samples. In 3 cases analysis showed the differences between the reference and GJB6 gene amplification.
Conclusions: Large deletions of the gene GJB2 and GJB6 can cause hearing loss in the Polish population. Positive samples need to be verified using an alternative reference gene.

U-29

Assessment of auditory development in infants with hearing loss

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Aim: Comparing auditory development as indicated by Polish version of the LittlEARS® Audiotory Questionnaire (LEAQ) with other measures of auditory function.
Material and Method: As a measure of auditory function ABR audiometry was performed in infants with hearing loss, aged 24 months and younger. To assess auditory development Polish version of LEAQ was administered to parents. Based on LEAQ total score hearing age was estimated and the difference between chronological and hearing age was calculated
Results: Statistically significant correlations between ABR thresholds and the difference between chronological and hearing age were observed.
Conclusions: The auditory development in infants with hearing loss assessed by the LEAQ is in a direct relation to the hearing threshold. Therefore LEAQ total score could serve to estimate the magnitude of hearing loss.

U-30

Evaluation of tinnitus annoyance using Tinnitus Handicap Inventory

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Background: A preliminary data on the evaluation of tinnitus annoyance according to hearing level is presented.
Aims: Evaluation of tinnitus annoyance on the basis of Tinnitus Handicap Inventory questionnaire (THI) in patients with normal hearing and with sensorineural hearing loss.

Methods: Material of the study was composed of 50 tinnitus patients divided into group I (patients with tinnitus and normal hearing) and group II (patients with tinnitus and sensorineural hearing loss). Audiological evaluation of the hearing level was done on the basis of pure tone audiometry. Including criterion was clinically significant tinnitus (longer then 5 minutes) located in the ears, however patients with tinnitus located only in the head were disqualified from the study. All the patients were asked to fill in the questionnaire – Tinnitus Handicap Inventory, to assess tinnitus severity, according to grades: slight – 1, mild – 2, moderate – 3, severe – 4, catastrophic – 5. Each patient was allocated to the one of described categories.
Results: Normal hearing was observed in 15 patients (group I), and sensorineural hearing loss – in 35 patients (group II). Assessment of THI showed in group I – slight tinnitus in 4 cases (23%), mild tinnitus in 2 cases (13%), moderate in 4 cases (23%), severe in 2 cases (13%) and catastrophic in 3 cases (20%). In group II slight tinnitus was found in 5 cases (14%), mild in 10 cases (29%), moderate in 5 cases (14%), severe in 7 cases (20%) and catastrophic in 8 cases (23%).
Conclusions: No significant correlation between the grade of tinnitus severity and hearing level was observed.

U-31

The usefulness of electrical stimulation of the hearing organ in tinnitus treatment

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Background: In the study, a preliminary report on the research is presented.
Aims: Evaluation of tinnitus in electrical stimulation [ES] group with comparison to placebo group.
Methods: 52 tinnitus patients divided into group I (40 patients – 58 tinnitus ears) – treated with ES of the hearing organ and group II (12 patients – 19 tinnitus ears) – placebo group. ES was performed with a silver probe immersed in 0.9% saline solution in the external acoustic canal. Direct, rectangular current was used, the intensity ranged from 0.15 mA to 1.15 mA. Fifteen ES were applied, 3–4 times weekly. In placebo group the procedure was similar, however no electric current was delivered through the electrode. The evaluation was done after the treatment, on the basis of the patient's report and a questionnaire of our own construction.
Results: Before the treatment in group I, permanent tinnitus was reported in 51 ears (87.9%), temporary – in 7 ears (12.1%), in group II – permanent tinnitus – in 14 ears (73.7%), temporary – in 5 ears (26.3%). After the treatment, in group I, permanent tinnitus was reported in 25 ears (43.11%), temporary – in 10 ears (17.24%), in 23 ears (39.65%) tinnitus disappeared. In group II – permanent tinnitus was reported in 10 ears (52.6%), temporary in 7 ears (36.9%), in 2 ears (10.5%) tinnitus disappeared. Regarding questionnaires, there were significant ($p \geq 0.05$) differences between the groups: in group I, improvement was observed in 25 ears (43.1%), no change – 28 ears (48.28%), intensification of tinnitus – 5 ears (8.6%), in group II – improvement in - 7 ears (36.8%), no change - 11 ears (57.9%), intensification of tinnitus – in 1 ear (5.3%).
Conclusions: Preliminary study showed considerably better results in group treated with ES, however, further research is necessary.

U-32

Tinnitus in children with normal hearing

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Introduction: Tinnitus in children is still rarely mentioned in medical literature. In general children do not report tinnitus spontaneously. The prevalence of pediatric tinnitus has been reported to range between 6-29%.There is no data in polish literature concerning the prevalence of tinnitus in children.
Objectives: The objective of this study was to estimate the prevalence of the tinnitus in 7 years old children with normal result of hearing screening test.
Methods: In this study 55201children and their parents were asked about the presence of tinnitus by answering a questionnaire. Additionally, children were asked if they can hear noise in their ears or head, before hand hearing screening test at school was conducted. The hearing screening test was performed using screening audiometer with air conduction in the range of frequency 0.25–8 kHz.
Results: The results showed that tinnitus was present in group of children (12.8%). Between children directly asked for tinnitus, 31.7% mentioned of having it. Over 56 % of children did not complained of tinnitus spontaneously to parents.
Conclusions: Tinnitus is frequent complain among 7 years old normal hearing children. It is recommended to include to a questionnaire an inquiry about the presence of tinnitus during hearing screening tests performed at primary schools.

U-33

Auditory training for patients after Partial Deafness Treatment – looking for tools to organize effective rehabilitation sessions

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Aim: Based of our experience we wanted to prepare the sound items of effective rehabilitation sessions for patients after PDT.
Material and Method: Our material consist of over 3500 cochlear implant patients included patients after PDT, an application of cochlear implant in patients with various level of low-frequency hearing. The set of sound samples consists of exercises with environmental sounds, vowels and high – frequency consonants, words and sentences in closed and open sets.The level of difficulty of developed tools as patients satisfaction were tested by questionnaires addressed both to the patients and speach therapists.
Results: Based on the questionnaire's results, both group found difficultness of the training tool appropriate. The patients expressed the need for such a training as they often experience high – pitched sounds to be uncomfortable.
Conclusion: The proposed set of sound samples will facilitate effective rehabilitation for patients after PDT.

U-34

Sounds of dreams, the nationwide programme for the rehabilitation of small children with hearing impairments

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Every year, around 750 children with hearing loss (HL) are born in Poland. Many of these children with confirmed HL (within the Universal Neonatal Hearing Screenings Program) often from familes with financial difficulties, do not have access to specialist rehabilitation and high-quality hearing aids.
In May 2006, the Orange Foundation (Poland) started an innovative programme called Sounds of Dreams aimed at helping children with HL. It is a unique programme at a European level. It offers free, comprehensive, and multistage help to: a child, its parents and therapists. The aim of the programme is to provide a child with care immediately after identifying HL, in an early stage of its life. Within the programme, we lend hearing aids to children, free of charge, and we provide them with systematic professional hearing and speech therapy at their homes. We also organize free two-week summer rehabilitation camps for children and their parents. The programme offers free trainings for therapists, where they develop their professional skills in working with young children, esspecially in application of the verbotonal method. The Foundation prepares its own free specialist publications and educational guides with sounds exercises. The Scientific Board of the Programme – consisting of prominent medical experts in the fields of laryngology, audiology, and the humanities – supervises proper implementation of the programme.
The International Scientific Conference of the Sounds of Dreams Programme was held in Warsaw in 2006 and 2010.

U-35

Questionnaire for Partial Deafness Treatment (PDT) satisfaction assessment

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Aim: The main purpose of this study was to develop the questionnaire to allow parents freely describe their perceptions of children after Partial Deafness Treatment (PDT). Open-ended questions were seen as the most appropriate format which enables parents to express complex attitudes and experiences associated with a cochlear implant.
Material and Methods: The tested group consisted of 20 PDT children implanted in the Institute of Physiology and Pathology of Hearing in Warsaw. All subjects from the group were cochlear implant users for at least two years. The experience with CI varied from 6 to 2 years. The questionnaire consists of 12 open-ended questions and was fulfilled by the parents.
Results: Parents answered the questions in their own words, without any specific suggestions from the questionnaire proposed by the authors.
Conclusions: The most common issue raised by parents was developing communication abilities connected with general increasing of child confidence.

U-36

Distance learning: Methodologies and experiences, the institute of physiology and pathology of hearing

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Increasing educational activity of the Institute of Physiology and Pathology of Hearing creates the necessity of implementing more effective teaching methods with the use of telemedia and Internet-based applications. Such methods are especially crucial for audiological education, including university studies conducted in co-operation with the UMCS University in Lublin, and recently opened College of Audiology.
The aim of the work is the development of methods and materials for distant learning associated with the subjects presently held by the Institute – Acoustics Fundamentals, Psychoacoustics, Medical Technology, Audiometry, Hearing Screening, etc. Assessment methods were also developed, as well as the methods of evaluation of effectiveness of educational process. The LMS (Learning Management System) platform and teleconferencing systems available at the Institute were used as means for data exchange, communication and management of the studies. Evaluation of studies' results shows that application of e-learning methods reduces costs, facilitates contacts between teachers and students and provides better access to information, without deteriorating competences and skills gained by the students in the teaching process. These methods are worth implementing on a wider scale at all levels of audiological education.

U-37

Nationwide network of teleaudiology in postoperative care over implanted patients

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Aim: "Nationwide network of auditory telerehabilitation centers" was introduced in 2009. It consist of 19 policlinics cooperating with Institute of Physiology and Pathology of Hearing, using state-of-the-art telemedical methodology and equipment. Practical considerations concerning service quality, patients approval, time and cost effectiveness are presented
Material and Methods: Questionnaires assessing quality and time effectiveness of teleconsultation were presented to the patients during standard follow-up visits in remote policlinics. Additionally, differences in travel time and cost were estimated.
Results: Patients approve teleconsultation as a good alternative to standard, face-to-face visit. Travel time and cost estimation of visit in local policlinic shows significant savings compared to visit in implantation center.
Conclusions: The model of extensive use of teleconsultations performed by experienced specialists from implantation centre to patient in cooperating policlinic proved to be reliable alternative to standard models of postoperative care, additionally providing substantial savings in time, cost and effort for the patient.

U-38

Telemedical hearing and vision screening system employing iOS based devices

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A design and implementation of the hearing and vision screening system dedicated for the popular iOS (iPhone/iPad/iPod Operating System) based devices is presented. The aim of the system is to promote hearing and vision screening tests internationally and to analyze collected results. The examination consists of speech in noise and tone audiometry tests, color vision and contrast differentiation tests. Whenever a test is completed the system automatically evaluates user's answers and generates results. Test data are sent to the server anonymously allowing for a detailed analysis. The paper presents analysis of the results collected for the population of about 5000 people in many countries all over the world. Presented data show that hearing and vision problems concern a considerable number of application users. The analysis was performed in two age groups (pre-school children and older) and concerned various types of hearing and vision disorders, including hearing and vision acuity and perception of colors. Tests for the first age group have been adapted to examining people with special educational needs. The telemedical system uses geolocalization and data capture technology, thus the results can be presented in a convenient form on world maps.

U-39

Audiometric characteristics of acute acoustic trauma – a multicenter study from the Pomeranian County of Poland

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Background: We investigated epidemiological and audiometric data from patients treated for acute acoustic trauma (AAT).
Aims: The quantitative and qualitative estimation of auditory system in patients with AAT.
Methods: Our study group comprised of 46 patients with AAT who were treated at five medical centers in the Pomeranian County, Poland between 2006 and 2010. The analysis included following factors: age, gender, cause of trauma, seasonal occurrence of disease, presence of tinnitus and vestibular symptoms, time delay before the first visit, type of initial audiogram, method of treatment (vasodilators, steroids and hyperbaric oxygen - HBO). We analyzed initial hearing loss and hearing gain in pure frequencies (0.5, 1, 2, 3, 4, 6, 8 kHz) and groups of frequencies: PTA (0.5, 1, 2 kHz), HTA (4, 6, 8 kHz), OAA (0.5, 1, 2, 4, 6, 8 kHz), and PMTA (0.5, 1, 2, 4 kHz).
Results: The most common AAT was observed in young males caused by gunshots, loud music and fireworks in winter and summer. Our analysis showed that initial thresholds were strongly lowered at 6 kHz – 49±20 dBHL and 4 kHz – 48±19 dBHL. The best hearing gain was also achived in these frequencies – respectively: 11±13 and 13±15 dBHL.
Conclusions: AAT is uncommon and still therapeutic problem. In our series we observed mainly unilateral sensorineural hearing loss and tinnitus with different treatment outcomes. The most common cause of failure was delay of treatment for more than 5 days.

U-40

Comparing and harmonizing the methods of auditory fitness for duty assessment

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Hearing evaluation for medicolegal purposes is performed in Poland basing on different legal acts, and with the use of different test criteria of social hearing ability. The aim of the study was to devise proposals of their unification.
The methods of work included the overview of literature, mainly the regulations currently in use in Poland, USA and Germany, and own research that was aimed to compare the consistency of results between tonal audiometry and speech comprehension tests (whisper test, speech audiometry) in the aspect of functional hearing ability assessment in subjects with normal hearing or sensorineural hearing loss.
The results of own research show that the percentage of individuals classified as subjects with normal hearing was significantly different, depending on the criterion used and the type of test. Generally, the percentage is higher for speech comprehension tests as compared to tonal audiometry. The percent of subjects classified by tonal audiometry as hearing impaired depends on the choice of audiometric frequencies and increases if higher speech frequencies (3, 4 kHz) are included. The highest test sensitivity and specificity in differentiating ears with normal/impaired functional hearing ability were found respectively for: audiometric mean 0.5, 1, 2 and 4 kHz at the cut-off point 25 dB HL, for speech comprehension threshold at the cut-off point 44 dB, and for whisper test at the cut-off point 4 m.
On the basis of the tests conducted and referring to literature data, there has been devised a proposal of the unification of the criteria of functional hearing ability assessment for performing hearing critical jobs.
This study was supported by the Ministry of Science and Higher Education of Poland (Grant IMP 18.7/2009–2010).

U-41

Development of Polish sentence test for children

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This study discusses both the development and evaluation of a new sentence test aimed at speech-in-noise measurements in children. The test is based on utterances generated by means of concatenating words according to the subject-verb-object sentence pattern. The sentences were mixed with masking noise at different signal-to-noise ratios (SNR), and speech recognition threshold (SRT) and the corresponding slopes of intelligibility functions at SRT point (S50) were analyzed. The test is both lexically

and phonemically representative for children's speech. The sentence lists comprise permutations of the same word material, which makes them perfectly phonemically equivalent. Normative intelligibility functions have been derived for children aged 3–10 and based on the total number of 283 listeners. For children aged 7–10, no statistically significant difference across all the 16 sentence lists was observed. For this group of listeners, only unbiased speech intelligibility data (verbal responses) were analyzed. For children aged 3–6, biased speech intelligibility data (picture-point responses) have been additionally applied. Differences across unbiased and biased data were analyzed and optimal sentence lists have been proposed. Mean list-specific SRTs and S50 were shown to depend on the age group. SRTs decreased with age of listeners, whereas an increase in S50 was observed when the age increased. The minimal and maximal list-specific SRT across age strata was –6.3 dB (for 10-year-olds) and 0.2 dB (for 3-year-olds), respectively. The minimal and maximal list-specific S50 across age strata was 6%/dB (for 3-year-olds) and 19.3 %/dB (for 10-year-olds), respectively.
Supported by a grant from Norway through the Norwegian Financial Mechanism (contract no. 7/2009).

U-42

Real-time speech stretching for diagnosing and supporting speech and hearing impaired patients

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Modifying speech signal by stretching or shrinking it in the time-domain finds many interesting applications to adiology and speech therapy. A study of real time-scale modification algorithms applied to diagnosis and therapy of speech and hearing impaired patients including children and youth is presented. A variety of signal processing algorithms was considered, namely: the overlap-and-add and the phase vocoder. Their effectiveness as well as real-time processing capabilities were examined. The developed algorithm including an additional speech microstructure analysis was implemented to stationary and to mobile computer platforms. The digital speech time transposer device was engineered. Based on the performed test results it was shown that time stretching can influence speech understanding positively in children with hearing impairments. Moreover, it is applicable to discover lateralization disorders and to correct stuttered and cluttered speech. The developed method is applicable also as a therapeutic tool in various sensory integration disorders of central nervous system manifesting as: dyslexia, aphasia, concentration problems, difficulties in learing foreign languages and others.

U-43

Temporal processing disorder associated with styrene exposure

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Background: Little evidence exists on the possible adverse effects of styrene on the central part of the auditory system. The present investigation aimed to study the possible association between styrene exposure and temporal processing abilities.
Methods: Fifty-nine styrene-exposed subjects and 50 non-exposed control subjects were tested. Pure-tone audiometry (125–8000 Hz) and 3 temporal processing tests (gaps-in-noise, frequency pattern test and duration pattern test) were carried out.
Results: Significant differences between groups were found for most of the audiometric thresholds for both ears. ANCOVA analysis showed that styrene-exposed subjects had significantly poorer performances on the frequency and duration pattern tests than non-exposed subjects, when including hearing level and age as covariates.
Conclusions: The results of the present research study suggest an association between styrene exposure and central auditory dysfunction characterized by a temporal processing disorder.
This study was supported by the Ministry of Science and Higher Education of Poland (Grant IMP 18.4/2008–2009).

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Abstracts

Y-01

A long-term remote support of patients with cochlear implants: From candidacy to fitting

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Background: The state cochlear implantation(CI) program in Russia has grown from less than 100 surgeries in 2000 to more than 1000 nowadays. The main features of this program include high centralization and great remoteness of patients from the centers.
Aims: To overcome the problem of increasing numbers of patients at long distances from CI centers, we propose the use of telemedicine technologies.
We have developed a concept of Long-Term Remote Support of CI patients (RSCI). This concept includes:
1) Remote candidacy: interactive patient examination; assessment of CT, eABR, and audiometry; and speech and language skills evaluation;
2) Remote surgery support: on-line live surgery with counselling, remote measurements (telemetry of the implant, eSRT, ART);
3) Remote rehabilitation: fitting, speech therapy, and interactive on-line teleconference patients and/or their parents/representatives.

Methods: Eight children aged from 1.5 to 6 y.o. were initially included in the study.
The teleconferencing equipment included a Polycom video server, Webex teleconference software, two portable computers, two web cameras and an Internet line with a capacity of ≥5 MBit/sec. The results of fitting sessions were assessed with the free field pure tone audiometry and disyllabic tests at three and six months after surgery. The patients' parents and specialists completed a number of specially designed questionnaires after the candidacy session, surgery, each fitting, and the on-line workshop.
Results: All the eight children were recognized as candidates for CI. One of them had a Mondini malformation with predictors of the "Gusher". All the surgeries were performed at the minor center by the local specialists who were using Med-El Pulsar devices. All intraoperative measurements were done remotely with the mean time of 15 min.
The efficiency of remote fitting proved to be similar to that of "face-to-face" programming, with no statistically significant difference (p=0.34). The parents' responses to the questionnaires indicated that all the stages were passed successfully.
Conclusions: The exceptional distances in Russia confirm the benefits of RSCI: it is easy to use, safe, reliable, and highly efficient for both patients and clinicians.

Y-02

Audiological results for different coupling modes of the Vibrant Soundbridge (VSB)

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Background: The active middle ear implant system Vibrant Soundbridge is an established method for the treatment of sensorineural, mixed and conductive hearing losses. The floating mass transducer (FMT) can be coupled to different structures: The incus, the stapes head or at the round window.
Subjects and Methods: Since February 2008, 58 VSB surgeries have been performed at the Innsbruck Medical University. A total of 32 patients received a unilateral VSB and 13 patients were implanted bilaterally. The implanted ears can be divided in three groups: In 36 cases the FMT was fixed to the long process of the incus, in 10 cases to the head of the stapes and in 12 cases at the round window. The average age in these three groups was 65.6 y, 56.3 y and 48.6 y, respectively (youngest: 9 years old; eldest: 84 years old). Bone and air conduction thresholds were assessed before and after surgery. Functional gain was calculated comparing aided and unaided air conduction thresholds. Speech testing was carried out using Freiburger monosyllables at 65dB and the Oldenburg sentence test (OLSA).
Results: Postoperatively, no clinically relevant changes in bone conduction thresholds could be observed in the implanted ears. The three groups showed differences in the unaided hearing condition. When using the VSB these differences diminish. Aided thresholds are in the range of 30–40 dB, word recognition scores around 80%.
Conclusions: The Vibrant Soundbridge is a safe and effective treatment for patients suffering from sensorineural, mixed and conductive hearing losses. For all three coupling modes of the FMT good audiological results can be observed.

Y-03

Hyperacusis in children with normal hearing threshold

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Introduction: Among 20 thousands patients registered in our Tinnitus Clinic, there are 0.5% children in the age betwen 6 and 16 years old. From that group of over 100 children mosty with tinnitus, about 40% have also hyperacusis and for half of them it is a reall problem.
Objectives: Characterization the group of normal hearing children with hyperacusis about etiology, audiological profile and results of the therapy.

Methods: There were investigated 8 normal hearing children with isolated hyperacusis. The audiolodical tests results were compared to control group. In each case after proper diagnosing and qualification to TRT the white-band noise generators or bed-side generators were applied.
Results: The success of the therapy after 8 months was estimated on 87% of significant improvement. Preliminary results suggest that improvement in treatment of hyperacusis in children is faster than in adults.
Conclusions: Normal hearing children with hyperacusis often have inappropriate DPOAE tests suggesting damage of hearing cells. The neural plasticity determines end results of treatment.

Y-04

Intratympanic dexamethsone is effective method as salvage treatment in refractory sudden hearing loss

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Objectives: To prospectively investigate the therapeutic efficacy of intratympanic dexamethasone (ITD) as salvage treatment in sudden sensorineural hearing loss (SSNHL) patients who had no response to initial systemic combination steroid therapy.
Patients and Methods: From May 2007 to June 2010, 415 SSNHL patients visited three tertiary referral centers within 7 days of disease onset. They were all treated with an identical protocol, a 10-day scheduled hospitalization and oral steroid treatment. Of these, 151 patients were totally unresponsive 2 weeks after treatment initiation according to Siegel's criteria. We prospectively divided these 151 refractory patients into three groups: those receiving no further treatment (control group, n=59) and those receiving one more 10 day cycle of oral steroids (systemic reapplication group, n=26), and those receiving ITD therapy (ITD group, n=66). Final assessment of hearing was carried out approximately 3 months after the onset of SSNHL. Hearing improvement was defined as demonstrating 'any' improvement according to Siegel's criteria.
Results: The initial average hearing thresholds of all groups were similar. Overall hearing improvement was observed in 10 of 59 patients in the control group, 4 of 26 in the systemic reapplication group, and 32 of 66 in the ITD group. No serious complications were observed. Analyzing by frequency, paradoxically, hearing of the low- and mid-frequencies was more significantly improved than high frequencies in the ITD group.
Conclusions: Intratympanic dexamethasone administration following failure of an initial treatment is effective and should be utilized as a salvage treatment in cases of refractory sudden sensorineural hearing loss.

Y-05

How to generate harmonious interactions. A long-term case study of a congenital deafblind girl with Cochlea Implant and her early educator

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The session is about a congenital deafblind girl with Waardenburg Syndrome with Cochlea Implant, of which monthly video taping between the age of three years and two months and six years has been accomplished.
In the shown sequences the girl interacts with her early educator. Video sequences are shown and cut into pieces of content. They are analysed in the plenum. Trust is outlined as a basic element of the dialogue between two partners.
Background and Aims: The content which will be presented is an extract of data of the doctoral thesis "early dialogues between deafblind children and their parents" (2006–2010).
This study is based on the project "dialogic development of infants" by Prof. Dr. Ursula Horsch where infants with and without disabilities are observed through the first 18 months of life by the use of video tapes.
Next to a sophisticated description of the dialogic structure and its development through the first 1.5 years, conclusions referring tangible impulses for early education shall be drawn.
Method: Parents and their deafblind children up to the age of six are monthly video taped in their natural setting for one year during an aimless interaction. The first four minutes of the data are analysed with the computer software Interact/Mangold. Afterwards quantitative and qualitative analyses are made.
Key Results: The results refer to one pair of the 25 participants and more than 200 videos of the study: A congenitally deafblind girl and her early educator in an individual tutoring situation. It is shown that the girl provides a lot of multi-plane turn-opening offers which are very sensitive answered by the early educator.
Conclusions: Altogether, following the child and being empathetic, but also respecting each other as strategies for successful early education are described and outlined via video examples.

Y-06

Audiological issues in a case of CHARGE syndrome

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Background: CHARGE syndrome is a genetic disorder resulting in the association of multiple congenital anomalies. The diagnosis of CHARGE syndrome is based on a combination of major and minor characteristics. Approximately half of individuals with

CHARGE have severe-to-profound hearing loss. Many of these individuals are very difficult to evaluate audiologicaly
AIMS: The authors present a case of a 4 year old child diagnosed with CHARGE syndrome that was referred to our department due to complete absence of expressive language and reaction to sounds. The child also suffered multiple life threatening malformations, retardation of growth and development, bilateral pinna malformation, feeding and swallowing problems.
METHODS: The child underwent late audiological assessment at age of 4 because the parents focused their concerns on treating the life-threatening malformations. The protocol included: acoustic immitance, observation audiometry and click ABR with light sedation during natural sleep.
RESULTS: The investigations revealed profound hearing loss and middle ear effusion on the left side and severe hearing loss on the right ear. Management: as the right ear was not suitable for conventional amplification due to major malformation of the external ear, a trial of hearing aid fitting was decided for the left ear. The lack of benefit using conventional hearing aid on the left ear referred the patient to ENT pediatric service to evaluate candidacy for cochlear implantation.
CONCLUSIONS: Any infant suspected having CHARGE syndrome should have a complete audiological examination since the frequency of sensory-neural hearing loss or vestibular problems are as high as 75–80%. Evaluation of hearing sensitivity during infancy and provision of amplification are important components in the process of auditory habilitation. Failure to monitor for auditory disabilities may result in increased developmental delay. Making decision for cochlear implantation in a child with CHARGE is challenging due to recurrent or permanent infections of the middle ears.

Y-07

Temporal bone 3D statistical morphometrics for implant design

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Background: The temporal bone offers a stable and convenient location to anchor implants. Such implants range from hearing aids to percutaneous ports for power supply and other possible future applications. Some descriptive statistics of distances between anatomical structures are available in the literature but a 3D average model would give a convenient basis for the design of implants.
Aims: The goal was to establish a 3D model of the temporal bone with dimensions that are representative of a given population. This model should quantify the distance between the bone, which is the basis of the anchoring, and the surrounding anatomical structures. It should allow the design of implants with the broadest possible target population.
Methods: Skull CT scans (voxel size: 0.4×0.4×1.25 mm) from 18 patients were anonymized and analyzed retrospectively. The method to create the model is inspired from shape statistics used, among others, in orthopedics. It is described as follows: 1. For each patient, a surface representing the boundary of the bony portion of the right ear was generated using Amira©. 2. These surfaces were aligned based on the external auditory canal and the sigmoid sinus. 3. All surfaces were cropped to the minimal common volume. 4. One patient's surface was randomly chosen as reference. The difference between each surface and the reference was computed as a deformation field. 5. Finally the mean surface was computed from the deformation fields by principal component analysis.
Results: A 3D model of the average temporal bone was generated. This model has dimensions that are coherent with results previously published (e.g. the depth available for a mastoidectomy is 22.3 mm whereas 24.3±2.8 mm was reported).
Conclusions: We presented a model of the temporal bone with representative dimensions that can be used for the design of an implant's geometry.

Y-08

The videostrobokymography in phoniatric practice

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Introduction: Thanks to videostrobokymography the vocal fold vibration from particular area of glottal chink, can be assessed in an objective way.
Aims: The aim of this study was the evaluation of vocal fold vibration with the usage of videostrobokymography in patients with different voice disorders.
Material and Methods: Material of the study included patients treated in the Institute of Physiology and Pathology of Hearing, Audiology and Phoniatrics Clinic. 103 patients with normal voices, vocal fold nodules, polyps, Reinke's edema, vocal cord paralysis and functional dysphonia were enrolled into the study. Open Quotient (OQ) and Close Quotient (CQ) from front, middle and rear third of vocal folds were measured.
Results: The study revealed differences of OQ and CQ in patients with normal voices and those with organic or functional dysphonia. Differences in parameters were calculated for each vocal fold region. The most significant differences of OQ and CQ mean values, calculated from separate glottal chink areas were observed in patients with functional dysphonia and vocal fold nodules. The mean value of OQ assessed from the whole glottal chink was the lowest in patients with functional dysphonia, while the mean value of CQ was highest in patients with vocal fold nodules.
Conclusions: Videostrobokymography is an useful complement to classical stroboscopy. It is helpful in differential diagnosis of voice disorders.

Y-09

Changes of auditory ossicles in rheumatoid arthritis. Scanning electron microscopic study

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Medical faculty Nis

Objective: The aim of this study was to define examine the existence of external changes on auditory ossicles caused by Rheumatoid arthritis.
Material and Methods: The study comprised of nine pairs of auditory ossicles (mallei and incudes) from patients with Rheumatoid arthritis, and five pairs of ossicles from persons without RA, taken during autopsies. The specimens were studied with JEOL JSM 5300 type scanning electron microscope (SEM). External changes of auditory ossicles were defined, affected areas were calculated, and expressed in percentage of total surface.
Results: Changes of auditory ossicles in patients with rheumatoid arthritis are significantly higher than in control ossicles, both on ossicular surface and articulations. Increased lysis of incudes, especially in the region of long propagation, corresponds to vascular damage. Articular degeneration is also present, indicating specific rheumatoid alteration. Both changes are statistically more intense in cases with longer duration of disease.
Conclusion: Rheumatoid arthritis reduces vascularity of auditory ossicles, and causes degeneration of articular surfaces.
Key words: auditory ossicles, rheumatoid arthritis, scanning electron microscopy

Y-10

Possibilities for young scientist at ENT ground

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Introduction: Recently age level for active participation in different projects went significantly down. From one hand it allows for young scientist new possibilities, but from second hand made competition from first year's during study at Universities. Students and young scientists are nowadays much more welcome to be active participants in scientific grant also funded by National or European institutions.
Aim: Aim of multicenter scientific activity in Our Institute was to offer participation for young scientist in different projects. It allows them and Us chance to get acquainted with modern tools, multidisciplinary programs. Presentation includes experience and results from many years of activity and awards received.
Results and Conclusions: Majority of members different group in IPPH are now involved in more specialistic projects. They are residents, psychologist, coordinators and others in Our structures. Young age involvement enable to make right choice of future direction. Such decision allow young people to be faster ready to participate in grants and clinical trials Us a specialist. From perspective of other stakeholders general level of science in specific areas is increased

Y-11

Our experience in the implementation of CI in patients with cochlear ossification

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Indications for cochlear implantation to date have increased significantly. Thus, otosurgeon increasingly have to deal with "difficult" case of implantation, such as full or partial ossification of cochlea. 232 cochlear implantations ware produced for the period since 2008 to 2010. The patients' age from 8 months to 37 years. The narrowing of the cochlea was determined in 21 (9.1%) cases with preoperative MRI and CT study. In two cases, the cochlea was closed totally, in a 19 – partially. Ossification was approved in 15 (6.5%) children when performing cochlear implantation. In most cases, 13 (86.7%) of 15 focus of increased bone formation are localized in the round window. The length of the ossification of ≤4 mm was diagnosed in 10 children (66.7%), 3–≤4 mm, 2 children had subtotal ossification. Inconsistency CT and MRI studies of the cochlea (bone occlusion of cochlear space) and operational findings established in 6 (28,6%) cases out of 21. Technique of surgery in cases with cochlear obliteration was tunelization bone ossification at the site up to depth 6–8 mm, if necessary. Probing with the difficulties of electrode introducing the deeper parts of the cochlea (the separation of fibrous occlusion) was used in 5 patients (2.2%) of 232 patients. Performing double cochleostomy (basal and middle cochlea curl with the introduction of split-electrode) was done in 2 operating. Complete introduction of the electrodes on telemetry data recorded in 11 (73.3%) patients of 15. In 2 cases, the last 2 electrodes have been disconnected due to lack of response. All patients successfully undergo auditory rehabilitation. Significantly worse results when using a split-electrodes.

Y-12

Method of mastoidoplasty after the open-technic operation on the middle ear

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Chronic suppurative otitis media is one of main problems in otorhinolaryngology. This pathologic process may lead to disability, hearing loss or cause intracranial complications. Patients with chronic suppurative otitis media that is accompanied by the development of cholesteatoma are being removed large areas of tympanic bone. After such operations trepanation cavity is formed which healing is one of the unsolved problems of otorhinolaryngology.

The problem of decreasing of the volume of the trepanation cavity is solved by mastoidoplasty – replacement of removed areas of tympanic bone with different transplantates.

The aim of our research was the development of new method of mastoidoplasty by using titanium perforated plates and autogenic bone chips of cortical layer of tympanic bone.

Nine patients were under observation with diagnosis: chronic otitis media. All patients were undergone the operation of open-technic on middle ear with further reconstruction of the posterior wall of the external auditory canal with titanium perforated plate. Cartilage taken from the auricle was layed on the plate from the side of external auditory canal and covered by skin. Mastoid cavity was filled up with autogenic bone chips of cortical layer of tympanic bone taken with bone extractor, this manipulations were accompanied by tympanoplasty.

After the surgical intervention good results were received. Patients were examined after 0.5, 1, 1.5 and 3 months after operation. After the last examination – external auditory canal wide, correct form, skin pale-pink, neotympanic membrane well-todo with vessels and no defect.

In such a way mastoidoplasty used according to our method allows to reconstruct architectonic of external and middle ear to improve the effectiveness of surgical intervention and functional result.

Inculcation of such method of mastoidoplasty allows to decrease the frequency of postoperative complications and social desadaptation of patients with chronic destructive otitis in distant postoperative period.

Y-13

Hearing results after three methods of tympanoplasty

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The functional results of patients treatment with chronic otitis media (COM) and cholesteatoma were researched in three groups using three different methods of tympanoplasty.

Materials and Methods: The functional results of tympanoplasty were evaluated based on audiometric data. Average thresholds of air conduction (AC), bone conduction (BC) and air-bone gap (ABG) on frequencies 0.25; 0.5; 1; 2 and 4 kHz were determined.

238 patients with COM undergone 496 operations, and in 6 cases the operation was performed on two ears. Based on analysis of 244 observations of COM, 169 (69,3%) were cases COM with cholesteatoma.

The first group is composed of the patients, who have undergone canal wall up tympanoplasty (CWU). This group includes 124 (50.8%) cases. The second group, who have undergone canal wall down tympanoplasty (CWD) – 61 (25.0%) cases. The third group, who have undergone tympanoplasty with mastoid obliteration (MO) – 59 (24.8%).

Results: The better results of ABG (13.7±1.2 dB) achieved by CWU then with CWD. The same goes for the greatest lowering of AC thresholds after tympanoplasty. MO has appeared to be more effective for the hearing reconstruction compared to CWD: ABG after MO was 15.8±1.5 dB, and after CWD – 18.2±1.1 dB, and AC thresholds after MO was 30,8±5,2 dB, while after CWD – 36.8±5.3 dB.

Thus, the patients with CWU and TMO have more stable hearing than the patients with CWD. It can be explained by the fact that in CWU and MO posterior canal wall is saved or restored, and the tympan membrane takes the natural position.

Conclusions: Based on this data, we concluded that the CWU tympanoplasty has the greatest functional efficiency and stability compared to CWD tympanoplasty and tympanoplasty with mastoid obliteration.

Y-14

Research of the influence of tamponade of the nasal cavity on the Auditory tube function using the data obtained by impedansometry

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Background: There are some pathophysiologic factors, such as nasal obstruction, adenoids, trauma and surgery of the head

and neck that related to the Eustachian tube and can lead to it's dysfunction.
Also the obstruction of the pharyngeal opening of auditory tube is able to cause its dysfunction followed by the eventual Acute otitis media. (Bluestone 2005).
Aim: Evaluate the changes of the Auditory tube function before surgical procedure, when the tamponde of the nasal cavity with cellulose tampons is applied; and those occurring further during the earlier postoperative period (5 days).
Methods: Impedansometry : tympanometry, test of the Auditory tube function (ETF) applying Toynbee and Valsalva's tests using the serial AA222 impedansometer; nasopharynx' and nasal cavity's examination with rigid endoscopes fixed for 30 and 70 grades angles.
Examination has been conducted before the surgery as well as on the 1st – and the 5th days after the surgery. The current research involved 20 patients who underwent the septoplastic surgery followed by the tamponde of the nasal cavity with cellulose tampons.
Results: Tympanometric indicators before the surgery were 19.1±43.76961215, on the 1st post-surgery day 73.65±70.99390263, on the 5th post-surgery day 5.55±35.35753474.
Statistically important deviations p=0.000132 (n=20, T=0, z=3.823) according to Wilcoxon criteria were discovered between the tympanometric indicators before the surgery and on the 1st first day after it.
According to ETF-function and Wilcoxon criteria the indicators prior to surgery deviated insignificantly from those of the 5th post-surgery day ($p \leq 0.05$).
Conclusions: According to tympanometric indicators the statistically viable renewal of the Auditory tube function occurs on the 5th post-surgery day.
At the same time (5th day) the tymapnic activity indicators by ETF-function are statistically close to the respective pre-surgery indicators.
Therefore duration of the nasal cavity tamponade, the method of its conduction, as well as the chosen form or surgical interference revealed to be key factors determining Auditory tube ventilation function during the septoplastic surgery.

Y-15

Dysfunction of auditory tube in patients with chronic nose diseases

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Urgency: Dysfunction of auditory tube can be consequence off different inflammatory, degenerative, adhesive and productive processes in nose cavity and nasopharynx. Important senses in development of this dysfunction have different barriers on the way of air flood in nose cavity and nasopharynx.
Frequently causes of these states are bend nasal septum, hypertrophy turbinate bone. In this event also play a part charging speed, turbulence, direction air flood, what irritate mechanic and chemical receptors of nose mucous. The irritation the last one calls changing of nose mucous lake a vasomotor dissension, hyper secretion and also in region of ostium auditory tube.
Through information by Krukov, Turovskuy, Shubin (Moskow) from 121 patients with dysfunction of auditory tube, in 93% this dysfunction is a result extra tube disorder.
Objective: To research the function of auditory tube in in patients with chronic nose diseases with tympanometry method.
Materials and Methods: We carried out tympanomety research and research of function of auditory tube with sample Toynbee and Valsave. We used impedance audiometer AZ-26, Denmark.
Results: We researched 32 patients with bend nasal septum and vasomotor rhinitis. When we asked the patients – they said that had not any complaints from auditory tube side. And we have such results over our tympanometry research:
In 23 patients (71.8%) – type A on tympanogramma;
In 9 patients (28.2%) – type C on tympanogramma;
And 19 patients (59.4%), from patients with tympanogramma A, have a disorder of passable in auditory tube.
Conclusions: Such rank, over our facts, that we received in our investigations we can say that most patients with chronic nose diseases, such as bend nasal septum and vasomotor rhinitis have hidden dysfunction of auditory tube, what we can not find only clinically, but must to use additional method researching - tympanometry method with sample Toynbee and Valsave. Such dysfunction in future can reduce to development different diseases of ear, that's why we must detect early.

Y-16

Congenital cholesteatoma in hearing screening in school children

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Aim: Between 2000 and 2011 we provided many screening programs in Poland. We totally screened almost 300000 children. Our aim was to evaluate, during hearing screening program in school children, level of hearing impairments, central disorders and tinnitus among them and also awareness of parents about problem with hearing among their children.
Method: Screening program was performed base on Sense's Examination Platform. During program we used Pure Tonal Audiometry, Central tests (DDT and GDT) and questionnaires (special parts for children and parents). There was special part dedicated for tinnitus. Questions was previously agreed by specialist from Our and cooperatives centers. Program was dedicated to children from cities and villages lower than 5000 inhabitants. Material consist of 285652 screened school age children (2008–2010).
Results: We found 42 cases with congenital cholesteatoma was clinically confirmed. It was clinically confirmed. That result is based on homogenous group of 6–7 years old children from villages and cities lower than 5000 inhabitants. Positive results for PTA was 13.1% and based on DDT was 15.6%. Total results (it means that some have both problems) – 19.1%.

Among children with hearing dysfunctions 50% have positive answer about tinnitus.
Conclusions: Faster diagnose of congenital cholesteatoma allows Us to performed earlier surgery. Cholesteatoma affected less space and initial follow up observation results has shown that there is less complications. Over 65% of parents don't realized about any problem with their children's hearing. There is significant social and economic problem. We continue that program during among other countries from other continents.

Y-17

Rehabilitation of children with chronic secretory otitis media and adenoid hypertrophy

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Background: Secretory otitis media (SOM) is a leading cause of conductive hearing loss in children. Insertion of tympanostomy tubes is the accepted form of treatment. Recently, several studies utilizing laser myringotomy have been published, but few of them present comparison results.
Aims: To compare the laser-made hole and grommet insertion in treatment of secretory otitis media.
Methods: 74 patients (148 ears) line ventilation tube (VT) insertion technique, 49 patients (98 ears) surgery by laser tympanostomy (LT). All types of surgery were performed under general anesthesia because adenoidectomy was done at the same time.
Results: The results of treatment were assessed on the basis of the otoscopic examination (recurrences of effusion, condition of the tympanic membrane, and audiological examination (puretone audiometry, tympanometry). The minimum follow-up period was 1 year. The recurrence rate was lowest in the LT (8%) group, and highest in the VT group (12%). Permanent changes in the tympanic membrane were observed in 9% of the ears after VT, 1% after LT. The use of laser during myringotomy has no negative effect on the function of the cochlea. Healing of the tympanic membrane after laser myringotomy was uneventful with a low percentage of permanent sequelae.
Conclusion: The Most effective treatment SOM would be insertion of ventilation tube or laser tympanostomy in a combination with adenotomy. VT in comparison with LT is more effective at long (6 months ≤) glued process with carrying of a tube 10–12 months. In other cases LT and insertion VT in treatment of SOM was no significant difference. Use LT reduces duration of treatment from 12 till 1.5 months.

Y-18

The frequency of visualisation of large endolymphatic sac and duct in patients with acute peripheral vestibular syndrome according to the data of MRI

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Background: Acute Peripheral vestibular syndrome (APVS) is the concept that covers a number of pathological conditions, each with unique characteristics (vestibular neuritis, Ménière disease, labyrinthitis, Arnold-Chiari malformations etc.). Incidence of these disorders is 16 per 1000 population (W. Goodman, 1996). Nowadays for understanding ethiopathogenesis of such syndrome we should visualize large endolymphatic duct and sac (LEDS) and surrounding inner ear findings (cochlear and vestibular dysplasia, asymmetry of the cochlear scalar chambers, abnormality of the semicircular canals (SCC) etc.).The aim of this study was to evaluate the incidence of LEDS in the own patients and to present our experiences regarding imaging findings and to compare it with the results of the world's statistics.
Methods: Cumulative analysis based on our own MR images of the inner ear obtained from 2008 to 2010 year (MEDEX clinic) of 48 patients with LEDS and surrounding anomalies and of 30 control subjects with PVS and not visualized LEDS.All subjects were examined using the CISS imaging protocol on a 1,5-T MR system(Siemens MAGNETOM Avanto Tim [76×18] SQ-engine).
Results: Among 48 patients (96 ears) with APVS (19 males and 29 females; age range 20–62 years) there were 40% of ears with isolated LEDS.Cochlear anomalies were present in 34% of ears with LEDS. Modiolar deficiency, gross dysmorphism and scalar asymmetry were seen in 73%, 42%, and 27% of abnormal cochleas, respectively. Vestibular abnormalities were present in 26% of ears with LEDS. Simple enlargement, gross dysmorphism and distortion of the lateral SCC were seen in 89%, 23%, and 15% of abnormal vestibules, respectively.
Conclusions: Isolated LEDS were only in 40% of patients with PVS. Each abnormality worsens hearing of patients, so we present our own, showing ethiopathogenesis of the APVS, algorithm for MRI diagnosis that may affect treatment decisions and prognosis.

Y-19

Analysis of influence of middle ear cavity volume change and External Auditory Canal (EAC) Upon transfer of sound in the middle ear

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We studied influence of middle ear cavity volume changes on sound transfer in the middle ear after tympanomastoidektomy. There were modeled 4 situations on each of 5 human temporal bones: intact temporal bone, closed and opened variant of tympanoplasty, mastoidoplasty with the restoration of EAC posterior wall (MPR). We studied influence of middle ear cavity volume changes on sound transfer in the middle ear after tympanomastoidektomy.According to the results of AAR at the resonance frequency, the best functional outcome was achieved in closed tympanoplasty type.

Y-20

Estimation results of rehabilitation the patients with Usher's Syndrome by cochlear implants

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Introduction: Usher syndrome (US) is the most common condition involving both hearing and vision loss. The hearing loss is associated with a defective inner ear, whereas the vision loss is associated with retinitis pigmentosa, a degeneration of the retinal cells. Among the deaf population the prevalence of Usher syndrome ranges from 0.6–28%, but a figure of 10% in schools for the deaf is generally accepted (Loundon et al, 2003; Young et al, 1996).
Material and Methods: We examined 48 individuals with retinitis pigmentosa and chronic sensorineural hearing loss. Of these, 20 were men (43%), 28 women (57%). Age of patients ranged from 14 to 65 years. Testing hearing function included: estimation of whispers and spoken speech, pure tone audiometry, acoustic impedancemetry. Amount 48 patients with chronic sensorineural hearing loss 25 patients (52%) had social adequate hearing and did not need hearing aids, for 20 patients (42%) hearing aids could be helpful, 3 patients (6%) had social inadequate hearing and needed cochlear implantation.
Results: We using the information from cochlear implantation in USA (2000), France (2003) , Netherlands(2006), England (2008) and Ukraine (2007). Among 282 patients given an implantation, 244 were congenitally deaf and 38 had Usher syndrome. The age at implantation ranged from 18 months to 44 years (mean, 17 years 6 month). The mean follow-up was 99 months (range, 9 months to 9 years).
The best rehabilitation results were obtained in children implanted before the age of 9 years (Loundon Natalie,2003). Oral language had significantly progressed in 9 of 13 at follow-ap. There was no relation between the visual acuity and the logopedic results (Ronald J. E. Pennings, MD, PhD, 2006).
Conclusions: The rehabilitation of patients with Usher's syndrome is possible by the CI. CI in patients with Usher's syndrome type I improve the audiologic performance when patients are implanted at an earlier age. All patients with US received CI achieved some listening and spoken language skills. These skills will help to decrease the sensory isolation in their lives in the future. For patients with Usher's syndrome where deafness is progressive and speech and language have developed normally, the multichannel CI can provide an alternative auditory communication system when vision is no longer functional. Usher's syndrome has caused a congenital profound deafness, it maybe necessary for the CI to be integrated into the child's normal speech and language development from an early age to obtain optimal results.

Y-21

Surgical treatment for tympanosclerosis in Institute of Physiology and Pathology of Hearing

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Introduction: Tympanosclerosis is the chronic hyalinization and calcification process of the tympanic membrane and middle ear mucosa leading to deformation and stiffness of the middle ear structures and walls with possible fixation of the ossicles. Tympanosclerosis is very diverse and widespread disease. Therefore, it is difficult to analyze the results of such an extensive and heterogenous material and to form the consensus about the surgical managment of these patients.
Aim: The aim of the study was to collect and asses the surgical treatment results of tympanosclerosis in Institute of Physiology and Pathology of Hearing.
Materials and Methods: From 1999–2011 tympanosclerosis was found in 3921 cases. The analysis was conducted in the group of 421 patients with total ossicular immobilization due to severe tympansclerosis in epitympanum. In about 90% cases changes in the attic were accompanied by focal changes in the tympanic membrane and on the walls of the midlle ear, as well as in the niche of the oval and/or round window.
Results: The auditory effects observed in 30–60 months postoperatively are differentiated. The best results were achieved in tympanosclerosis limited to the attic only, where the head of the malleus and/or the body of the incus were removed during procedure, whereas the worst results were in the cases where changes were found also in the round window niche. Satisfactory results were found in these ears where removal of tympanosclerosis

limited to the oval window niche was followed by stapedotomy. The follow up period was minimum 3 years.
Conclusions: This allowed us to compare early and late results and gave the answer to the question whether preferred standard procedure had positive impact on functional achievements.

Y-22

The effectiveness of rehabilitation in the treatment of patients with vertigo and balance disfunction caused by vestibular disorders. Preliminary report

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Background: Vestibular rehabilitation has become popular and widely used in many countries in the management of patients with vertigo, dizziness and disequilibrium. In Poland there are still just a few institutions that offer such form of treatment.
Aim" To evaluate the effectiveness of physical exercises in the treatment of vertigo and balance disorders caused by vestibular dysfunction, to analyse the parameters defining the postural stability and to determine whether age has an impact on the process of vestibular compensation.
Material and Methods: Participants of this study were 50 randomly chosen patients (40 women and 10 men, aged 20–85) treated for vertigo and balance disorders in the Institute of Physiology and Pathology of Hearing in Warsaw. Subjects were performing individually designed rehabilitation program during 4–20 weeks. In order to assess the effect of rehabilitation, the computerized dynamic posturography (sensory organization test) was used. For the statistical analysis Wilcoxon test was performed. Statistical significance was assumed at a level of 0.05.
Results: Overall improvement in stability was observed in 90% of patients. The balance of participants significantly improved. The vestibular and visual deficits significantly decreased. There was no difference in the results between the age groups.
Conclusions: 1. Vestibular rehabilitation had influence on improvement in postural stability of patients and age did not affect the results. 2. Our results are the basis for continuing the prospective, randomized research with larger number of patients.

Y-23

Microtomographic imaging of the discomalleolar ligament

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Background: Discomalleolar ligament (DML), also know as the Pinto ligament, is a structure connecting the temporomandibular joint (TMJ) tissues with the malleus in the middle ear. It runs threw the petrotympanic fissure as a remnant after the Meckel's cartilage. Knowledge about the ligament is important during diagnosing otic symptoms connected with the temporomanibular disorders or performing the temporomandibular joint arthroscopy.
Aim of the Study: The aim of the study was to present and examine detailed radiologic anatomy of the junction between the TMJ and the middle ear due to the fact that the DML is not described in classic textbooks of anatomy.
Material and Methods: Study was conducted on 15 specimens en bloc of the temporal bone with complete TMJ from adult cadaver bodies. They were scanned by means of SkyScan 1017 microtomograph in resolution of 30 um. Topography of the structures was examined and measurments were carried out.
Results: Tomographic scans revealed the DML in 13 specimens (87%). The mean length of examined structure was about 7 mm what corelated with the diameteres of the petrotympanic fissure.
Conclusions: Our study confirmed that there is an evident connection between the TMJ and the malleus as well as that this relationship can be imaged thanks to microtomography. Clinical implications of the presence of the studied structure show that it should be taken under consideration when diagnosing pathologies in this region.

Y-24

DNA analysis of connexin genes (GJB2, GJB3, GJB6) in patients with bilateral sensorineural hearing loss in Slovakia by MLPA pre-screening method (preliminary results)

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Mutations of connexin genes account for the majority of hereditary prelingual hearing loss in most countries. MLPA ([**M**ultiplex **L**igation-dependent **P**robe **A**mplification) is one of the modern molecular-genetic techniques that fulfill the criteria of rapid and cost-effective method, especially if deletions are to be of diagnostic concern. We chose a commercially available MLPA test kit (SALSA MLPA KIT P163-C1, MRC-Holland) to investigate connexin genes in molecular-genetic prescreening of hearing impaired subjects. The kit contains 49 MLPA probes that include probes for all GJB2 (connexin 26) and GJB6 (connexin 30) exons and four GJB3 (connexin 31) probes for the most frequent mutations (hot-spots). Additionally it contains probes for POU3F4 (X-linked deafness) and WFS1 (Wolfram syndrome) genes. Our set of subjects contained 60 patients with bilateral sensorineural hearing loss, mostly of prelingual onset, that were investigated at the Ist ORL Clinic as well as subjects attending one of the three boarding schools for deaf children in Bratislava. Subjects or their legal representatives had to sign an informed consent form prior to molecular-genetic investigation. Blood samples were taken for DNA analysis. Mutation of the gene GJB2 was detected in 30 subjects (50%), while only one proband had mutation in the GJB6 gene (compound heterozygote with GJB2 gene mutation 35delG). No GJB3 mutation was found among investigated subjects. The mutation spectrum included: 35delG, ivs1+1G≤A, 167delT, 313del14 in GJB2 gene and delD13S1830 in the GJB6 gene. The most common deletion 35delG was detected in 23 subjects, with 16 (26.7%) homozygous cases. Compound heterozygosity accounted for 6 cases (10%).The exact genetic etiology of hearing loss was proven in 22 subjects (36.7%). Pre-screening by MLPA method was shown to be an effective tool for detection of common genetic causes of non-syndromic SNHL, providing early etiologic diagnosis for further genetic counseling.
The research was supported by grant APVV-0148-10.

Y-25

Clinical peculiarities of the non-syndromic sensorineural deafness in children of Belarus

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Background: It is known about 100 genes associated with deafness. Most commonly detected mutation is deletion 35 delG in the GJB2 gene.
Aims: Clinical presentations of deafness caused by 35delG mutation are the object of our research.
Methods: 35delG mutation was detected with the help of blood's polymerase chain reaction. The children's parents were asked about risk-factors and timely diagnosis of deafness by means of questionnaires.
Results: 339 children with severe to profound bilateral sensorineural deafness were examined. Homozygous genotype was detected in 46,6%, heterozygous genotype in 11.5% of children, without mutation (normal genotype) – 41.9%.
The questionnaires showed that impaired hearing was first noted by the parents when the child was under 1 year old in 45% in normal group, 49% in heterozygous and 57% in homozygous. Deafness was established by the doctors under 1 year old in 20% in normal group, 31% in heterozygous and 37% in homozygous. Examined children have parents with deafness in 3% in normal group, 23% in heterozygous, 30% in homozygous.
Frequency of risk-factors of deafness in prenatal period is similar in all groups. Frequency of risk-factors in perinatal period is greater in normal group (62%) in comparison with others (47%). Most significant known reasons for deafness as reported by the parents were as follows: ototoxic antibiotics intake in 25.4%, other factors in 23.2% in normal group; heredity in 28.2%, ototoxic antibiotics intake in 15.4% in heterozygous; heredity in 32.3%, ototoxic antibiotics intake in 13.9% in homozygous.
Conclusions: 1. Our study demonstrates frequent occurrence of 35delG nuclear mutation (58.1%) in sensorineural deafness. 2. Deafness noted by parents and established earlier in groups of patients with 35delG mutation (heterozygous and homozygous). 3. Heredity is main reason of deafness in groups with 35delG mutation whereas other risk-factors (ototoxic antibiotics intake, nueroinfections) is main in group without mutation.

Y-26

A Nonsense Monosyllabic Speech Audiometry Test in modern Greek

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Although speech audiometry is becoming an established clinical procedure in Greece, it has not been used in the areas of hearing aid fitting and aural rehabilitation due to the limited number of materials.
The purpose of the present study was to develop a suprathreshold speech audiometry test for native speakers of Modern Greek language. The specific aims of the present study were to construct phonemically balanced lists of nonsense monosyllables, and to perform a preliminary investigation of list equivalence.
Nonsense monosyllables with possible CV, VC and CVC phonemic combinations in Greek were chosen as stimuli. Nonsense monosyllables are appropriate for amplification assessment and aural rehabilitation treatment programmes, since they permit a detailed analysis of the phonemic errors made by the listener. In addition, they ensure that vocabulary and memory effects are reduced. To examine list equivalency, the final lists were administered monaurally in 5 dB increments to 40 adults (20 males and 20 females) whose hearing was within normal limits.
A nonsense monosyllabic speech audiometry test for speakers of Modern Greek has been developed. The test material consists of two lists, each of which contains 50 open-set monosyllabic combinations. No more than two lists with 50 nonsense monosyllables were able to be developed due to the criterion of phonemic differentiation. The lists satisfied the criteria of equal phonemic balance, composition of Modern Greek speech, phonemic differentiation and equal average difficulty. Statistical analysis was performed by analyzing repeated measures. Results revealed no statistical significant differences between the lists.
These findings suggest that the test appears to be a useful additional tool for clinical purposes. Further investigations with larger numbers of subjects with normal hearing and different types and degrees of hearing loss are required to determine the validity and reliability of the lists.

Y-27

Automatic detection of spontaneous otoacoustic emissions

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Otoacoustic emissions (OAEs) are weak sounds produced by ear. They are important for examination of hearing status. OAEs may generated spontaneously (spontaneous OAE – SOAE) and as a response to stimuli. SOAEs are usually measured by synchronizing them with click stimuli – so called synchronized SOAEs (SSOAEs). Currently SSOAEs are not in general use in hearing examinations. One of the reasons is that there is no common and objective algorithm for detecting particular emissions components in such signal.
Here we present an algorithm which can automatically detect SSOAEs. It was tested both on real SSOAEs and on simulations. Procedure is based on FFT, which is used in iterative way: after the strongest peak in frequency is found, the sinusoid corresponding to such peak is subtracted. This decomposition is continued until there is no peak in signal spectrum that is bigger than the noise envelope.
After peak are detected they are tested to check how much they differ from noise. The best results were found for two testing parameters. First parameter is used to compare amplitude of peak with its neighboring noise from noise spectrum. Second test is comparison with neighboring noise from signal spectrum.
Testing parameter were found based on simulations. The accuracy of results is that algorithm can achieve even up to 97% of true SSOAEs peaks while false are on the level of 0.02%.

Y-28

Early audiological features of congenital GJB – associated hearing loss

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Early detection of congenital hearing loss in infants is one of the most important problems of clinical audiology. Despite considerable genetic heterogeneity of autosomal recessive nonsyndromal hearing loss, mutations in one gene, GJB2, are found in up to 50% of patients. In the literature there are not enough works describing early audiological findings at newborns and children of the first year of a life with GJB2-associated congenital hearing loss. The aim of this study was to characterize objective audiological features in children with GJB2-associated congenital hearing loss diagnosed during first year of life by means of auditory brain-stem response (ABR) registration.
Congenital nonsyndromal hearing loss was diagnosed in 80 patients. Usual ENT inspection, tympanometry, automatic auditory brainstem response, otoacoustic emissions, and genetic counseling were performed. The examination was repeated by each three months.
GJB2 mutations were identified in 71.2% of children (57/80). A total of 11 different mutations were revealed. The mutation c.35delG was observed at 51 children, including 40 with homozygous genotype and 9 with compound heterozygous genotype. In two cases second mutation was not found. The pathological genotypes which consist of another GJB2 mutation were observed in 6 cases. From 34 observed infants with GJB2 related hearing loss in 28 cases the OAE was not registered in maternity hospital.

It was demonstrated that the GJB2-associated hearing loss was bilateral, symmetric, nonprogressive during the first year of life. Most of children with GJB2 mutations did not pass universal newborn hearing screening and had severe degree of hearing loss in 90% of cases. Final diagnosis was done during first four months of life in half of cases. Modern screening tests can improve identification of newborns with hearing impairment.

Y-29

Speech evoked brainstem responses in Arabic and Hebrew speakers

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Background: Based on studies in English speakers, it has been proposed that speech-evoked brainstem responses (ABRs) may be used clinically to assess central auditory function (e.g., Auditory Processing Disorder diagnosis). Whether the same procedure can be used across speakers of different languages remains unclear, because recent findings suggest that language experience affects even subcortical processing of speech.
Aim: The goal of the present study was to characterize brainstem responses to the syllable /da/ in Arabic and Hebrew speakers using the United States (US) developed BioMARK procedure.
Method: Auditory brainstem responses evoked by both clicks and the syllable /da/ were collected from 37 normal-hearing students Arabic and Hebrew speakers from the University of Haifa.
Results: The BioMARK scores of both Arabic and Hebrew speakers fell within the range of 0–5, well within the US norms. Neither the transient nor the sustained components of the brainstem response differed significantly between Arabic and Hebrew speakers. Across the two groups, timing of the major components of the speech-evoked response as well as the correlations between the speech- and click indices were well within the US norms.
Conclusions: Brainstem processing of the syllable /da/ does not differ between speakers of English and speakers of Semitic languages such as Arabic and Hebrew. Those data indicate that the BioMARK system can be used in non English speaking populations.

Y-30

Diagnosis and therapy of children with cochlear implant system

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Language communication is necessary for social and emotional development of each person. This applies particularly to deaf children. In the case of profound hearing loss it is very important to early apply a cochlear implant system, increasing the range of information reaching the child in the auditory way. This has a huge effect on speech understanding and evolution of mental processes. It allows the child, with an additional and regular rehabilitation, to achieve a much higher level of language development and acquisition of knowledge about the world than children without this appliance. The sooner a child has the opportunity of hearing and rehabilitation, the easier it will adopt in the environment of the hearing.
The object of the study was the diagnosis and therapy of two children with a cochlear implant system at preschool age. The aim was to show the overall functioning at different levels: cognitive, motor, emotional and, above all, the communication level of deaf children with cochlear implant. The research method used was the individual case method, aiming at the reliable diagnosis as well as the preparation and conducting of appropriate speech therapy. Direct observation of the tested children helped to evaluate their development in various spheres of life.The tested children had a very different family situation.
The boy was neglected by his parents, however the girl owed the good functioning in language communication to intensive rehabilitation and systematic stimulation of auditory and linguistic skills in the family environment. Consequently, the children's communication difficulties varied. At the the age of 5, the boy spoke just a few words heard from the environment but the girl reached the level of development of a 6-year old child.
The results showed that difficulties in the use of speech occur in the absence of rehabilitation and systematic help in the family environment in which the child with an implant develops. Diagnosis and speech therapy should take into account the level of language development and learning opportunities of the children with implants. Close cooperation with the family is crucial. Especially children with difficult family situations should be provided with psychological, educational, and speech therapies to compensate for or reduce the disparities of deaf children with their peers.

Y-31

Tinnitus among school age children

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Aim: The Institute of Physiology and Pathology of Hearing, between 2000 and 2010, provided many screening programs in Poland. Totally screened were over 300000 children in school age. Our aim was to evaluate the level of hearing impairments, central disorders and among them and also awareness of parents about problem with hearing among their children.

Method: Scientist and students involved in investigation used Pure Tonal Audiometry, Central tests (DDT and GDT) and questionnaires (special parts for children and parents) with special part related to tinnitus. Questions was previously agreed by specialist from Our and cooperatives centers. Program was dedicated to children from cities and villages lower than 5000 inhabitants from western provinces of Poland.

Material consist of 101951 screened school age children from 4556 primary schools (2008–2010).

Results: Hearing Screening Program result were based on homogenous group of 6–7 years old children from villages and cities lower than 5000 inhabitants. Average level of complains about periodic or constant tinnitus was 14.7% (in Warsaw, capital city 33.1%). Average level of positive result is 19.2%. What is more, among children with hearing dysfunctions 50% have positive answer about tinnitus.

Conclusions: Parents awerness is very low, over 65% of them don't ralized about any problem with their children's hearing. Over 70% children with hearing impairments have worse marks at school. There is significant social and economic problem. Early detection of tinnitus may allow us reduce heavy distant implications.

During different programs which we realized, we observed big differences between big cities and villages about level of positive results with tinnitus. We continue that program during among other countries from other continents.

Y-32

Diagnostical value of otoacoustic emission indices for evaluation of the results of glycerol-test in patients with diabetes mellitus II, hearing loss and tinnitus

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28 patients at the age of 22–56 years with diabetes mellitus II, hearing loss and tinnitus were examined. The aim of this research is identification of the diagnostic value of the DPOAE registration method in such patients.

Investigation was provided in the following way: anamnesis, examination of the ENT-organs, pure-tone audiometry, glycerol-test (analyzed with reference to changes of the hearing function), DPOAE.

Intervals between level of tinnitus and OAE amplitude before and after glycerol-test changed significantly ($p \leq 0.05$). Evaluation of glycerol-test with the DPOAE gave positive answer in 16 patients. 4 patients (14.28%) had negative glycerol-test results in pure-tone audiometry, but positive DPOAE glycerol-test results. We consider it shows that DPOAE is more sensitive than pure-tone audiometry.

According to high correlation between objectivity, rapidity, effectiveness and easiness, using DPOAE for evaluation of glycerol-test results is expedient and advisable.

Y-33

Isobolographic analysis of ototoxic interactions between amikacin and furosemide in mice – preliminary report

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Background: Aminoglycoside antibiotics and loop diuretics have long been known to have ototoxic effects. However, characteristics of pharmacodynamic interactions of these drugs is still not recognized.

Aims: To evaluate type of interaction between ototoxic drugs, the isobolographic analysis was used, which is an experimental, mathematical-statistical model of evaluation of pharmacological interactions between drugs, given in different fixed and definite combinations.

Methods: Amikacin in a dose of 1250 mg/kg, furosemide in a dose of 100 mg/kg and their combination at the fixed-ratio of 1:1 were injected intraperitoneally to Albino Swiss mice. Auditory brainstem responses were used to assess the hearing threshold at 15 and 30 min after the drug injections.

Results: The combination of amikacin with furosemide resulted in synergistic interaction.

Conclusions: Results of presented work prove that the isobolographic analysis is very precious and usefull to estimate types of interaction of ototoxic drugs. It gives new possibilities in the recognition of mechanisms of action of ototoxic drugs and in prevention of ototoxicity.

Y-34

Selective labyrinthine laserdestruction for vertigo treatment in patients with Meniere's disease

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Background: 25% of patients with Mineire's disease (MD) are required surgical intervention because of lack of standard treatment. Decompression and endolymphatic sac's drainage are the most commonly used technique of surgical treatment but unfortunately even skilled surgeons identificate it in 50% of cases.
Aims: To examine pulsed neodymium laser radiation effect on lateral semicircular canal (LSC) ampullar receptor for selective suppression of its function in cases of MD and long-term follow-up observation.
Methods: 158 patients with unilateral MD were included in this study. Age range 24–69 years. Disease average duration was 7.2 years. Moderate hearing loss was in 101 (63.9%) cases, severe hearing loss was in 57 (36.1%) cases. All patients were underwent surgical treatment – LSC ampullar receptor laserdestruction with the use of pulsed neodymium laser (pulse duration – 2.5–3 msec, pulse energy – 10 J). At first classical antrotomy is performed, then quartz fiber gets in contact with the LSC wall near ampula. The laser energy exposure on the bony canal wall is conducted by defocused laser beam in such a way that the main energy releases in the canal lumen. In this way bony canal wall left intact, that is very important because any perilymphatic space rupture in MD leads to deafness.
Results: The patients' examinations in 1 year after surgical treatment show that the hearing levels in both (operated and contralateral) ears remain unchanged, vestibular excitability of the operated ear reached 10–20% of normal levels (based on caloric test results) so that our patients recovered from devastating vertigo episodes. Case follow-up within 10 and more years showed stability of obtained results.
Conclusions: 84% of patients recover from vertigo episodes and all patients have unchanged hearing levels in the affected ear using our surgical treatment method in patients with MD.

Y-35

Comparison between Auditory Steady State Responses and Auditory Brainstem Responses in objective prediction of hearing thresholds

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Background: Auditory Brainstem Response (ABR) to clicks is a well recognized auditory tool to assess the hearing thresholds particularly at high frequencies. Although some frequency specificity can be obtained by using tone bursts, they may have low correlations with the hearing thresholds at low frequencies. Moreover, their application for predicting a full audiogram is a considerable time consuming. Auditory Steady state responses (ASSR) may serve as an alternative comprehensive tool for predicting the thresholds in both low and high frequencies in a relatively short time session.
Aim: The goal of the present study was to compare the predictive values of ABR and ASSR measures in subjects with normal hearing and with sensory neural hearing loss (SNHL).
Methods: Air conduction and bone conduction of pure tone audiometry and ASSRs to frequencies between 500–4000 Hz were recorded in 33 subjects with normal hearing and with SNHL. ABRs to clicks and to tone bursts (TB) at 1000 Hz and 2000 Hz were also recorded.
Results: In normal subjects, the differences between the behavioral thresholds (2000–4000 Hz) and to ABR-clicks were smaller (3 dB) than the differences between the behavioral and ASSRs in the same frequency range (15 dB). Pearson correlations were higher for ABR as compared to ASSRs (0.8, 0.7 respectively). However, using ABR-TBs resulted in insignificant differences compared to ASSRs with respect to the behavioral thresholds in normal group. In contrast, in SNHL group, differences between behavioral and ASSR thresholds were smaller (7–10 dB) than ABR-TB (15–16 dB). The correlations of ASSRs with the behavioral thresholds at 1000 Hz and 2000 Hz were significantly better than for the ABR-TB.
Conclusions: ASSR demonstrated high frequency specificity, smaller test sessions, good correlations with both air and bone conduction, all these make ASSR more appropriate for predicting audiograms in subjects suffering from SNHL.

Y-36

Effect of presentation level on greek phoneme recognition errors by normal hearing adults

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Phonemic error analysis plays an important role within the areas of hearing aid fitting and aural rehabilitation. It is mainly used to measure disability and evaluate treatments.
The objective of the present investigation was to analyse the effect of presentation level on phonemic recognition errors of adults using a phonemically-balanced nonsense-monosyllabic speech recognition test.
Forty normal hearing adults (20 males and 20 females) participated in this experiment. All subjects were native speakers of Modern Greek and lacked previous experience on nonsense syllable tasks. Monaural (right ear) Performance-intensity functions were obtained from each participant. Presentation level started at 0 and increased in 5 dBHL increments until a 100% recognition score was obtained. All testing was conducted in a double-walled, sound-isolated chamber. Stimuli were presented in isolation and included consonant-vowel, vowel-consonant and consonant-vowel-consonant phonemic combinations. No response alternatives were provided to the subjects. Responses at each level were analyzed for place/manner errors. The statistical significance for differences in phoneme-recognition among the presentation levels was examined by the chi-square test.
Results revealed that high levels of phoneme recognition were maintained over a wide range of presentation levels with a consistent increase in place/manner errors at lower hearing levels. Stronger level dependencies were observed for consonant than for vowel recognition.
Data from this study can be used for the construction of response frames to represent perceptual confusions that are most likely to occur.

Y-37

Cochlear dysfunction caused by vertebrobasilar insufficiency

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Background: Sensorineural hearing loss has many etiologies, including vascular sources. Because the blood supply to the inner ear originates from the vertebrobasilar system, vertebrobasilar insufficiency can be presented with hearing loss.
Aims: To describe the clinical characteristics and the level of hearing loss caused by vertebrobasilar insufficiency.
Patients and Methods: 30 patients with vertebrobasilar insufficiency and hearing loss were participated. The mean age of the patient group was 46 years (ranging from 34 to 58). Patients with normal otoscopy and timpanometry type A parameters where include in the study. Doppler sonography, MRA were performed to verify the vascular origin of cochlear dysfunction. For exclusion the patients with hearing loss of central origin brainevoked potentials was used. In the study of hearing loss the otoacoustic emissions (TEOAE,DPOAE) and audiometry were used.
Results: The results of audiometric threshold and OAE from 30 patients were analyzed. Bilateral hearing loss was observed at the 12 cases, unilateral at the 18 cases. Regarding to results of audiological investigation, the thresholds shifts of hearing loss in gaps of 15-30 dB at all frequencies was detected in all patients. OAEs was detected at the 6 patients (20%).

Y-38

Diagnostic pathway for patients with indications to PDT

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Introduction: Partial Deafness (PD) is a condition in which hearing loss occurs in at least 1 frequency critical to speech understanding. Current options for Partial Deafness Treatment (PDT) rely on preoperative hearing preservation, which, along with the use of different means of acoustic and electric stimulation, enable extending the indications for various assistive hearing devices. Possible solutions include acoustic methods only, the use of hearing aids or middle ear implants, electric complementation, and a combination of electric and acoustic stimulation.
Method: There is over 960 patients with PDT indication with different types of PD (AS, PDT-EC, PDT-EAS, PDT-ES). We observed and create diagnostic pathway, which could improve and make more efficient patient's way along therapy. Our aim was to eliminate unneeded time consuming points according to LEAN management theory.
Results: The extension of PDT indications created an opportunity for patients with different hearing impairments who obtained no benefit from a hearing aid and did not qualify for standard cochlear implant application. The authors' observations are based on the findings that preservation of preoperative hearing had been achieved in 97.1% of adult patients (the longest 9 years' observation) and in 100% of children (the longest 7 years' observation). According to law regulation procedures must be projected meticulously.
Conclusions: Concept of PDT allow Us to offer hearing preservation in every case procedure with very good results for patients. All procedures which are in pilot study are under analyze to be implemented in World Hearing Center.

Y-39

The relationship between Central Auditory Processing Disorder and Specific Language Impairment. Samples of Polish lingiustic test in the assessment of CAPD and SLI

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A lots of scientists work at the relationship between CAPD and SLI. It is supposed that CAP deficit in auditory processing of immediate signals influences on latter problems with language. Children, which present a quick auditory processing, indicate the correct language development in contrast to children, which present the delay in processing of immediate signals, they as well show deficit of expressive language. Therefore, the measurements of Central Auditory Processing ability of immediate signals can be used in diagnosing children with high risk of language deterioration. Above mentioned case proves that Central Auditory Processing Deficit could be helpful as behavioural index in language and learning deterioration and could particularly be useful in early diagnostics of children with gradually lowering results in learning and the language deterioration.

The impact of CAPD on SLI is proved in various experiments, especially when it comes to abilities of temporal aspects. Auditory temporal aspects explore children abilities as so to order sounds towards their integration within a word and their combination within the meaning . Used during the experiments stimuli are tonal, onomatopoeic and vowel band. Children have to repeat sound by their rotation. That ability particularly temporal order indicates weaker performance of SLI children. Speech, as intricate process of sound sequence presented quickly, contains continual processing and high velocity. Therefore children with SLI show difficulties in auditory processing of immediate sounds processing sequence; those children indicate problems with the language intelligibility and expression.

Bishop's studies indicate that SLI children have problems with signal processing with intrastimulus interval 300 msc. Likewise Tallal's researches, which conclude that above mentioned children have also difficulties with processing of immediate signals in intrastimulus interval lower than 150 msc. Worth of emphasizing is that the majority of signals, which form the language, last about 100-300 msc what may explain problems, which SLI children have with building the word representation.

Therefore, following the world-wide reports on the relationship between CAPD and SLI, I would like to introduce samples of behavioural tests for the Polish language which embrace auditory temporal aspects. Presented hereby tests, which take temporal sequence and order into consideration, are tests assessing temporal sequence disorder in the auditory processing. To above mentioned tests can be included:

- Duration Pattern Test,
- Pitch Pattern Test,
- Auditory Fusion Revised Test.

For the Polish Language I have chosen sample tests elaborated on the American version for the English language. These tests are classified into Auditory Fusion Revised Tests among which can be mentioned tests detecting temporal gaps (like Auditory Integration Test, Word Intelligibility by Picture Identification WIPI) and tests embracing especially Dichotic Digits Test and Auditory Number Test ANT.

Key words: Central Auditory Processing Disorder CAPD, Specific Language Impairment, linguistic tests, temporal aspects, temporal processing

Y-40

Evaluation of graphomotor development and laterality in deaf and hearing impaired children

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Introduction: Grafomotor activity is based on melokinetic and constructive praxis and could be used in assessment of written language developmental disorder. Laterality, i.e. expression of dominant cerebral hemisphere, is an important factor in graphomotor skills development. Dyslaterality is defined by underdeveloped lateralized movements within psychomotor activities (Bojanin, S., 1985).

Aim: The aim of the study was to evaluate impact of congenital deafness on development graphomotor skills and homogeneity of dominant laterality.

Sample: Experimental group consisted of 20 children with congenital severe to profound hearing loss, aged 5 to 8 years. Control group consisted of 20 hearing children of the same age, without any other developmental disorder.

Methods and Instruments: Graphomotor assessment was done by Test of shapes and Test of figure sequence. Laterality homogeneity was determined using Test for dominant laterality (Bojanin, Ćordić, 1992) Test scores were classified as successful, partly successful and failed.

Results: In Test of figure sequence 15 were fully successful and 5 partly successful. Majority of the hearing impaired children have shown some kind of dyslaterality. Four of them had discrepancy between sensory and motor laterality, whereas another seven have had general dyslaterality. Seven kids have had fully determined dominant half of the body. Asymmetric hearing loss found in 3 kids was not regarded as dyslaterality. Dyslaterality did not affect graphomotor skills in children in this study. All of the results were subject to statistical analysis.

Conclusions: Majority of hearing impaired children express some form of dyslaterality. However, laterality homogeneity did not affect graphomotor development considerably in either group.

Y-41

The topography of the third section of maxillary artery relevant to surgical procedures performed in this region

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Background: The vascular supply to the lateral maxilla occurs via branches of the third section of maxillary artery and is essential for preserving the vitality of this region. Therefore a precise knowledge of the topography of the maxillary blood supply is highly important during different surgical procedures such as extractions, sinus lifting, endoscopy of the maxillary sinus or Le Fort I osteotomy.
Aim of this Study: was to investigate the arterial vascularization of the lateral maxilla and its clinical implications.
Material and Methods: The study was performed on 2 human cadavers. Firstly carotis communis artery was injected with latex. Then the arteries of lateral maxilla were prepared anatomically and the local main arteries, the number of macroscopically discernible branches and anastomoses were recorded. Moreover endoscopic explorations were performed.
Results: The findings of our study indicate that the lateral maxilla is supplied by branches of the posterior superior alveolar artery (PSAA) and the infraorbital artery (IOA) that form an anastomosis in the bony lateral antral wall, which also supplies the Schneiderian membrane. This anastomosis can be placed also extraosseous, vestibular to the antral wall. The mean diameter of both arteries was measured and showed a mean caliber of 1.6 mm.
Conclusions: The topography of arterial supply of lateral maxilla was analized by means of dissection and pictures of endoscopic stills. The rather large caliber of these vessels was recorded. Because the vitality of local bone and healing behavior of the oral mucous membranes depend on local arterial supply, surgical procedures in this region have to be performed very carefully and the transection of endosseous anastomosis should be avoided.

Y-42

Characteristics of hearing disorders at vertebro-basilary vascular insufficiency

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According to R.A. Flaudi and A.V. Shakhova (2009), auditory and vestibular disorders are the most beloved early signs of vascular disease, that is caused by essentially blowing off circulation processes of blood in brain.
The aim – to explore the state of auditory system in patients with Sensorineural hearing loss (SHL), accompanied by varying degrees of intensity of vertebro-basilary vascular insufficiency (VBVI) according to 1, 2 and 3 groups, and in healthy persons and conduct a comparative analysis of findings.
Research methods – hearing tone levels in conventional (0.125–8) kHz and extended (9–16) kHz frequency range, rheoencephalography, research of brainstem (BACP) and cortical (CACP) auditory caused potentials.
In 30 patients with initial manifestations of VBVI (group 1) revealed hearing loss of tone in the region of (6; 8; 9; 10; 11.2; 12.5; 14 and 16) kHz, which were respectively (15.6±0.4; 16.9±0.8; 17.2±1.7; 19.3±2.1; 23.5±3.1; 29.1±2.8; 32.4±3.3 and 27.1±3.8) dB and the phenomena of disfunction in the cork department of auditory analyzer, as evidenced by lengthening the latent period of peak (LPP) component N2 CACP to 278.2±3.3 ms at the rate of 251.1±3.3 ms.
In 57 patients with expressed displays of VBVI (group 3) were found hearing loss of tone in the region of (9; 10; 11.2; 12.5; 14 and 16) kHz, which were respectively (47.4±3.5; 67.4±3.7; 69.1±4.2; 74.1±2.7; 72.3±3.2 and 71.1±1.2) dB. In this group has been a violation in the cork department of auditory analyzer, where LPP component N2 CACP made (307.5±4.2) ms, and also in brainstem, where lengthening of LPP of the V wave of BACP testifies to (6.03±0.04) ms, at the rate of (5.56±0.01) ms.
In 32 patients of 2 group revealed significant changes of less than in 3 group.
These data are important in topical diagnosis and implementation of preventive measures in patients with SHL in combination with VBVI.

Y-43

Effects of orthognathic surgery on the upper airway and development of sleep-related breathing disorders

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Introduction: Orthognathic surgery is used regularly to treat dentofacial deformities. Mandibular retropositioning (setback procedures) produces an inferior repositioning of the hyoid bone and posterior displacement of the tongue and soft palate. It can compromise airway space, alter the physiologic airflow through the upper airway, and predispose patients to develop obstructive sleep apnea syndrome (OSAS). Additional maxillary advancement as an element of the surgery decreases the amount of negative changes on airways. Conversely advancement of the maxilla or/and mandible causes widening of the airway in both anteroposterior and lateral dimensions. This effect would translate to better airflow and decreased airway resistance.
Aim: The aim of the work was to investigate how orthognathic procedures affect the velo-oropharyngeal anatomy and could cause/treat breathing disorders.
Material and Methods: Our study included 35 patients who underwent mandibular retro/anteropositioning with or without maxillary advancement at the Department of Maxillofacial Surgery, Oral Surgery and Implantology, Medical University of Warsaw. Pre- and postoperative lateral cephalometric

radiographs were analyzed for evidence of changes to the posterior airway dimension. The main outcome measures which were compared include: cranial base maxillary angle (SNA), cranial base mandibular angle (SNB), posterior airway space (PAS), mandibular plane and hyoid distance (MPH), soft palate length (PNS-P), Go-Pog distance (gonion-pogonion).
Results: Mandibular retropositioning greater than or equal to 5 mm decreased the posterior airway space and showed evidence of soft palate elongation. However, as determined by cephalometric analysis, mandibular retropositioning greater than or equal to 5 mm in combination with maxillary advancement had no significant effect on the posterior airway space or soft palate. Maxillomandibular advancement increases the volume of the naso,oro,hypopharynx by anterior movement of the soft palate, tongue and anterior pharyngeal tissues.
Conclusions: Our study clearly showed that orthognathic surgeries cause changes in oropharyngeal airway. Therefore patients who are undergoing these procedures should be evaluated pre and postoperatively for evidence of OSAS (excessive daytime somnolence, snoring, increased BMI, other medical conditions releated) and send for an overnight polysomnography if OSA is suspected. Then the proposed treatment plan may be modified according to the risk of potential airway compromise or even to improve it.

Y-44

Effectiveness of electrical round window stimulation for tinnitus suppression in 13 patients with severe unilateral tinnitus

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Background: Tinnitus is a widespread symptom with unclear and heterogeneous pathogenesis. Therefore different treatments have been advocated for tinnitus with varying success rate.
Aim: This study investigated the effectiveness of acute electrical stimulation (ES) on tinnitus suppression. Different sinusoidal and pulsatile stimulation paradigms have been applied at the level of the round window under local anaesthesia using the test version of the 3WIN stimulator. The secondary aim of this study was to look for predictive factors that could help identify patients who could potentially benefit from ES.
Method: 13 patients with severe unilateral tinnitus were included in the study after a thorough anamnestic, medical, audiological and psychological work-up.
Results: Five patients (38%) experienced complete inhibition of tinnitus and in four patients (31%) partial inhibition was observed. The other four patients (31%) did not experience any change in their tinnitus during ES. In summary 69% of the subjects showed some benefit from ES. Two of the patients with unilateral deafness who experienced complete tinnitus inhibition during ES received a cochlear implant. Both of them experience full relief of the tinnitus as long as the implant is switched on. Except for the negative influence of the duration of tinnitus no significant correlations were found between the anamnestic, medical, audiological or psychological parameters and the results of ES.
Conclusions: Almost 70% of patients with severe unilateral tinnitus can benefit from electrical stimulation at the level of the round window. The positive result of the acute ES test seems to be the only parameter useful for selection of patients who could potentially benefit from chronic ES for tinnitus suppression.

Y-45

Language and social development of a child with a profound hearing loss

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The ability to communicate with others is one of the child's most important mental needs. It is also essential for its normal development. A child with a damaged hearing organ has limited possibilities of using the phonic language. The lack of language development handicaps many mental processes, and distorts social and emotional development. Thus, it is obvious that hearing disorders affect not only speech, but the child's overall development. This paper aims at presenting how a deaf child develops socially and acquires language and communication skills. Applying the case-study method enabled the exact diagnosis of all the aspects of the child's functioning. Using a number of reseach methods and information from different sources made it possible to produce the child's multifaceted characteristics. Levels of psychomotor development, hearing perception, motor skills of the speech apparatus, pronounciation, the child's mental lexicon, narrative skills, reading and writing skills, and general language performance were graded. Moreover, the development of the child's and the mother's communication skills was analysed.
Research results confirm that, if proper rehabilitation is provided, a profound prelingual hearing loss does not pose a significant obstacle in communicating in the phonic language. It is crucial to early detect hearing disorders, use a hearing aid, undertake proper rehabilitative actions, and engage the environment in the therapy. The rehabilitation should be based on auditory education, which aims at raising a child's interest in the world of sounds by providing it with sound stimuli. Early hearing improvment helps it acquire the understanding of speech faster, and constitutes a basis for the further development of speaking. Moreover, learning to read early is of great significance. A deaf child should be helped to learn the rules of a language and its phonemic structure. However, acquiring grammatical rules does not always guarantee the desired communicative effect. And vice versa – deaf children who did not master grammar fully, can easily communicate with the environment. Thus during the language formation process three kinds of competence, namely linguistic, communicative, and cognitive, are developed simultaneously.

Y-46

Central hearing disorders and the risk of dyslexia among children at the age of six

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Learning to read and write is a complex process of acquisition. School failures in this field may result from global retardation to the mental development, environmental negligence or social misadjustment. However, there is a group of children who are considered to be intelligent, talented and healthy, having proper environmental and educational conditions, and yet the commonly used methods of teaching fail in their cases. These children face serious difficulties of both specific and selective nature, in learning to read and write. They do not apply to all skills which are taught at school, but rather to those associated with reading and (or) writing.

Children with specific difficulties in reading and writing, namely "Dyslexic children", can mask their deficiencies in reading and writing, so that the developmental dyslexia is discovered too late, even though accompanies a student from the beginning of the school education and very often leads to secondary symptoms.

Research work concerning the central hearing disorders and symptoms of dyslexia risk confirms that there is a considerable number of children with various developmental disabilities. Tests were conducted among the group of 14 people at the age of 6. The method used in the study was to analyze the case studies. The Scale of the Risk of Dyslexia and tests for the diagnosis of central hearing disorders were used such as: a test separable of hearing , FPT and DPT tests, a test of speech understanding in noise and a test of pitch differentiation. After examining the scale of risk of dyslexia, there were signs revealed which indicated the possibility of subsequent disturbances of a dyslexic among 5 children. The difficulties of these children were manifested mainly through the difficulty in perception and expression of sounds. All children at risk of dyslexia have difficulties with the differentiation of sounds (the length and pitch). In the case of two children with the high risk, there were big problems revealed connected with hearing the words in noise.

Among the remaining nine children, there was no risk of dyslexia symptoms observed, nevertheless these study tests of central hearing disorders showed problems with central auditory processing, three people were not even able to discern the difference between the height and length of sounds.

Analysis of the results confirms the dependence of the risk of dyslexia on the central hearing impairments. Among the tested children the problems which emerged were as follows: disturbances in the differentiation of height, length of sound, difficulty in understanding the speech in noise or the pitcher lateralization of the left-ear-side. According to the caretakers, children have also difficulty in understanding comments as well as spelling them. A major problem was the difficulty in concentrating on what the teacher was saying. The scale of the problem of central hearing disorders and as a consequence, the subsequent difficulties in learning to read and write as well as obstacles encountered during the further levels of the school education, is highly visible nowadays.

Y-47

Correspondence between central auditory processing disorders and learning difficulties of 3rd grade students of elementary school

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Frequently occurring ear diseases, omnipresent noise and exposure to loud music have a negative influence on the quality of auditory perception, especially as far as young people are concerned. Problems with speech comprehension and auditory concentration may negatively influence their performance at school. Thus, in order to prevent its serious complications, we should address the problem of central auditory processing disorders.

There has been a research on how central auditory processing disorders and learning difficulties are related. The study group included 64 3rd grade students of elementary school. They were of normal intellectual capacity and were not affected by any hearing disorders. The first area of research concerned auditory concentration, ability to define timing of the sounds, speech comprehension in white noise and the ability to discriminate between sounds of different frequencies and durations. Learning difficulties were understood as problems with acquiring literacy and numeracy as well as problems with learning foreign languages.

65 per cent of the students were diagnosed with the central auditory processing disorder. The two most frequently disturbed processes were the discrimination of sound frequencies (FPT) and speech comprehension in unfavourable acoustic conditions (Speech In Noise Test) –44 per cent and 36 per cent of the subjects respectively. Negative results of these two tests were often related to the difficulties with conducting other central tests. Subsequent tests revealed the number of children affected by the following disorders: problems with discrimination of sound duration (DPT) – 14 per cent of the subjects, ability to define timing (DDT) – 11 per cent, gap detection threshold (GDT) – 6 per cent.

Questionnaires revealed that almost 30 per cent of the 3rd grade students of elementary school have learning difficulties. Every fourth subject has reading and writing problems, and every sixth has difficulties in learning a foreign language. The students have least difficulties with counting/numeracy. An additional questionnaire confirms the incidence of difficulties in foreign language learning.

Results of the research conducted show that there is a correspondence between central auditory processing disorders and learning difficulties of 3rd grade students of elementary school. It has been observed that the cause of learning difficulties of 75 per cent of the children may be CAPD. In our subject group, central auditory processing disorders have substantial impact on foreign language learning, which is proved by a 70 per cent correspondence between their occurrence.

Y-48

Sound reception in young musicians

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Hearing damage due to exposure to loud noises is currently one of the main causes of sensorineural hearing loss. Nowadays, we are more and more exposed to the noise outside our place of employment, which contributes to the emergence of the hearing loss, also among young people.
The aim of this thesis is to present the state of the hearing organ in young people exposed to loud noises, particularly musicians. Hearing assessment was carried out on the basis of pure-tone audiometry, a complex survey and interviews.
Two groups were studied. The first consisted of fine arts students – speciality music education. The latter – young people playing in music groups. The total number of respondents was 53, 33 of whom were the students, while 20 – the musicians. The study results show hearing conditions among 18% of the students and 55% of the musicians playing in groups.
The conditions occured mainly in the high-frequency range. They appeared more often among a group of young people playing rock music. As the surveys show, the musicians, already at this stage, complain about difficulties in understanding quiet speech and complex utterances of other people, which means that the problem, already in such a young age, is burdensome and creates trouble in social functioning.
What is curious is the fact that over 80% have never had their hearing test done before, which indicates that the audiological tests are not widely used. The fact might be thought-provoking, as it is widely known, that the knowledge of the current state of the hearing organ among this particular group of people is extremely important. Moreover, the respondents themselves eagerly participated in the study, showing considerable interest in the outcome and the reasons of lowering the treshold of their hearing.

Y-49

Angiogenesis in head and neck tumors – in literature and own studies

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Angiogenesis is a process of formation of the preserved blood capillaries, in contrast to vasculogenesis, in which endothelial stem cells play the crucial role and this was first described by Folkman in 1971. The process of angiogenesis accompanies some physiological phenomena and many pathological conditions. Excessive angiogenesis as well as its diminution has a negative impact on the homeostasis of the organism. There are several endogenous factors participating in angiogenesis- both stimulating the growth of vessels, such as VEGF (vascular endothelial growth factor), TNF alfa (tumor necrosis factor-alpha), PDGF (platelet-derived endothelial cell growth factor), NO (nitric oxide), aFGF (acidic fibroblast growth factor), bFGF (basic fibroblast growth factor), angiopoietin 1 and 2, and TGF-beta and inhibiting the process such as: angiostatin, endostatin, thrombospondin 1, platelet factor 4 and troponin 1. Prolonged hypoxia of cells (eg. in a tumor, in which intensively proliferating cells constrict the vessels) is an example of exogenous proangiogenic factor. The process is also characteristic for inflammation, ischaemia and "cell stress". However, the phenomenon of angiogenesis has been best defined on the basis of its observation in understanding the biology of cancer. At the end of the twentieth century angiogenesis inhibitors were introduced to the arsenal of treatment strategies for malignant tumors.
The authors present the phenomenon of angiogenesis for the biology of head and neck tumors, discuss its clinical aspects and indicate the prospects of therapy based on its inhibition.
The Department of Otolaryngology , Medical University of Silesia in Katowice in cooperation with the Department of Molecular Biology, Faculty of Pharmacy , Medical University of Silesia has examined the activity of genes associated with the function of metalloproteinases in patients with squamous cell carcinoma of the larynx and its significantly higher activity in cancer tissue compared to healthy tissue has been found.

Y-50

What makes adults with acquired hearing impairment take up hearing aids or communication programs and achieve successful outcomes?

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Rehabilitation interventions such as hearing aids and communication programs are effective for adults with hearing impairment, but their uptake and outcomes are suboptimal. This clinical study with a longitudinal component investigated the predictors of hearing aid and communication program uptake and of successful outcomes. All 153 participants were Australians aged over 50 with acquired hearing impairment seeking help for the first time. Participants met with a clinical audiologist to complete a hearing assessment and discuss intervention options (hearing aids, communication programs, and no intervention) with a decision aid. Participants considered their intervention options for one week before making a decision.
Six months later, of the 153 participants, 66 participants (43%) had obtained hearing aids, 28 (18%) had completed communication programs, and 59 (39%) had not completed any intervention. For those who had obtained hearing aids or completed communication programs, self-reported outcomes (Client-Oriented Scale of Improvement, International Outcome Inventory,

and reduction in hearing disability) were recorded three months after intervention completion.
Logistic and linear regression identified seven significant predictors of intervention uptake and of successful outcomes when other variables were held constant: self-reported hearing disability, stages of change, locus of control, communication self-efficacy, socio-economic status, application for subsidized hearing services, and intervention expectations. Clinicians should especially discuss hearing disability and stages of change, the most robust predictors of intervention uptake and of succesful outcomes, when helping clients make optimal intervention decisions.

1st International Conference of the Endoscopic Paranasal Sinus Surgery and 4th International Course in the Endoscopic Sinus Surgery

Abstracts

FESS-1

Anatomic variations in the paranasal sinus region in patients undergoing FESS with navigation system in Institute of Physiology and Pathology of Hearing

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Introduction: The introduction of navigation system into sinus surgery has significantly improved the quality and expanded the boundaries of endoscopic sinus surgery. In the Institute of Physiology and Pathology of Hearing we perform every year about 500 endoscopic sinus surgeries. Approximately 10% of them are done under the assistance of navigation system. The main aim of our study is to expose remarkable anatomic variations of sinus region among the patients qualified to FESS with navigation system and to emphasize on the usefulness of navigation system in revision surgeries, extensive polyposis, sphenoidotomy, operative approach to the frontal sinus drainage pathway and neoplastic sinonasal disease.
Methods: We analysed preoperative CT scans of paranasal sinuses in 50 patients who underwent FESS with navigation system between January 2009 and April 2011. In each of them we assessed: the presence and anatomic variations of middle turbinate and uncinatus process with its upper attachment, the depth of ethmoidal roof according to Keros scale, presence of Haller or Onodi cells, anatomy of frontal recess using modified Kuhn classification, position of arteria ethmoidalis anterior et posterior, existence of inferior turbinate hypertrophy, septal deviation, pneumatized septum or crista galli, protrusion of arteria carotis interna and nervus opticus into sphenoid sinus, the shape and symmetry of sphenoid sinuses, the extent of the disease according to Lund McKay classification.
Results: Among analysed Ct scans we have found: partial absence of middle turbinate due to previous operations in 22%, concha bullosa in 30%, paradoxally bent middle turbinate in 12%, resected processus uncinatus in 34%, processus uncinatus or the rest of the upper part attached to: lamina paparycea in 54%, etmoidal roof in 31%, basal lamella of the middle turbinate in 15%. The depth of ethmoidal roof in Keros classification was: I in 30%, II in 61% and III in 9%. Haller's cells were present in 36% and Onodi cells in 32% of cases. Protrusion of arteria carotis interna into sphenoid sinus was seen in 68% and protrusion of nervus opticus in 28% of patients. Agger nasi cells were detected in 94%, frontal cells type K1 – 36%, K2 – 11%, K3 – 23%, K4 – 2%, suprabullar cells in 30%, frontal bulla cells in 18% and ISSC in 10%.
Conclusions: The navigation system allows surgeon to recognize intraoperatively the most important landmarks and surrounding vital structures in 3 dimensions, facilitatating safe, precise operation and total surgical eradication of the disease.

FESS-2

Bacterial cultures in patients with chronic rhinosinusitis

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Introduction: The majority of patients treated in Rhinology Clinic have chronic rhinosinusitis (CRS) diagnosis. Moreover CRS is one of the most common health care problem. According to epidemiological data, this problem affects 15% of Polish population. The study was undertaken to identify bacterial cultures and existence of antibiotic resistance among patients with CRS treated in the Institute of Physiology and Pathology of Hearing, Rhinology Clinic.
Methods: The study was conducted among patients who had nasal swabs taken between January 2010 and March 2011. A group of 34 people was chosen. All of them had CRS diagnosis according to the definition of Rhinosinusitis Task Force agreed in 2003. Demographic and clinical information was gathered from patients medical history. Microbiological results of nasal swabs, including bacterial and fungal culture and antibiograms, were analyzed.
Results: There were 24 positive bacterial cultures of 34 taken. 13 from females, 11 from males. Fungal growth had not been observed. Age ranged from 25 to 73 (median 58.5). 10 patients had chronic sinusitis with polyps. The most frequent additional diseases were cardiovascular problems-reported in 9 cases. 3 patients had aspirin triad. 19 patients had undergone previous sinus surgery (15-1 procedure, 3-2, 1-3). Microbiological data: Colonisation was found in 18 nasal swabs. 10 patients had Methicillin-Sensitive Staphylococcus Aureus (MSSA) (in 1 case a coexistence of Pseudomonas Aeruginosa resistant to Extended-spectrum β-Lactamase (ESBL) was detected) , 5 had Haemophilus Influenzae (in 2 cases coexisting with Streptococcus Pneumoniae) and 1 other had Streptococcus Pneumoniae. In the remaining 5 nasal swabs: Proteus Mirabilis, Staphylococcus Aureus MSSA macrolides-lincosamides-streptogramins B resistant (MLSB), Enterococcus Cloace, Pseudomonas Aeruginosa and Staphylococcus Epidermidis Methicillin-Susceptible Coagulase-Negative (MSCNS) were detected separately. One patient had a Methicillin-Resistant Staphylococcus Aureus (MRSA). Antibiotic resistance was shown in 9 nasal swabs.
Conclusions: Bacterial species detected from patients with CRS, match with the data reported in literature. Staphylococcus Aureus was the most frequently isolated bacteria. Large number of positive bacterial cultures might be caused by the high percentage of patients after surgical procedures. Despite frequent antibiotic therapy in patients with CRS, only in 5 cases a resistance to drugs, used in therapy, was shown.

FESS-3

Endoscopic procedures in frontal osteoma resection

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Introduction: Osteoma of the paranasal sinuses is the most common benign tumor. The most symptomatic osteomas are located in the frontal sinus. If they cause symptoms, they are always treated surgically. Until recent, external approach has been the gold standard. Due to improvements of endoscopic techniques, frequency of removing of frontal osteomas endoscopically has increased.
Objectives: To present our experience in endoscopic resection of frontal osteomas.
Methods: Review of three case reports.
Results: Three patients underwent endonasal surgery for symptomatic frontal osteomas. Two of them had Draf type IIA frontal sinusotomy. One patient underwent endoscopic modified Lothrop procedure (EMLP). In all cases an intraoperative image- guidance system was used. There were no complications postoperatively.
Conclusions: The success of endonasal surgery depend on good preoperative computerized tomography, individual anatomic conditions and the skill of the operating surgeon. Different endoscopic techniques with the use of three-dimensional visualization system appear to be effective, less invasive ones and have a low morbidity than external approaches.

FESS-4

Our experience with endoscopic modified Lothrop procedure

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Introduction: Endoscopic modified Lothrop procedure (EMLP) is a technically demanding surgical treatment of complicated frontal sinus diseases. There are only few relative contraindications to EMLP, like underdeveloped frontal sinuses or narrow anteroposterior distance between the anterior skull base and nasal bones. The optimal outcome of this technique depends on many conditions especially image-guidance system, advanced endoscopic equipment but most of all on surgeon experience.
Objectives: Our experience with endoscopic modified Lothrop procedure.
Methods: Analysis of 12 cases of patients with different frontal sinus pathology who underwent EMLP at our institution from January 2010 to April 2011.
Results: Most of patients complained of headache, smell disorder and recurrent infections. More than half of them were allergic to aspirin. There were 3 patients after previous surgical treatment. Follow-up ranged from 2 months to 1 year. Four patients complained of headache located in the forehead lasting for up to 6 weeks after surgery.
Conclusions: EMLP is an effective and safe form of surgery in the management of recalcitrant and complicated frontal sinusitis with low risk of complications. The operative success rate is correlated directly with frontal sinus ostium. Preservation of mucosa in the frontal recess should be paramount. EMLP provides follow-up visualization into the frontal sinus to monitor for recurrent disease.

FESS-5

Radiological anatomy of frontal recess

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Introduction: Anatomy of frontal recess can be very complex and thereby associated with frontal recess obstruction and chronic frontal sinusitis. The aim of this study is to assess anatomy of the frontal recess in order to investigate if incidence of Kuhn and intersinus septal cells is linked with higher incidence of frontal sinusitis.
Methods: The authors reviewed 100 left and right sides of coronal and sagittal computed tomography (CT) scans of the sinuses obtained from 50 consecutively presenting patients (100 sides) who were being evaluated for frontal sinusitis.
Results: In 29% of analyzed sides no frontal cells were found, but frontal sinusitis was found in 24.14%. Type I frontal cells was found in 33% , type II in 19%, type III in 18% and type IV in 1% of analyzed sides whereof inflammation was found in 45.45%, 52.63%, 33.33% and 100% respectively. Intersinus septal cell was found in 8 patients whereof inflammation occurred in 3 of them.
Conclusions: Frontal air cells were identified in 71% of analyzed sides of frontal recess. Bilateral occurrence of frontal cells was almost six times higher than unilateral, and type I cells were the most common type of frontal cells. The incidence of frontal sinusitis was higher in patients with frontal cells (32%) than in patients without frontal cells (7%). Based on this findings we consider that anatomic variations in the frontal recess play a vital role in frontal sinusitis.

key words: frontal recess air cells, computed tomography, Kuhn cells, intersinus septal cell

FESS-6

Phototherapy improves quality of life and symptom scores in allergic rhinitis patients

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Introduction: Rhinophototherapy using a combination of UVA (25%), UVB (5%) and visible light (70%) is known to have a powerfull immunosuppressive effect for which it has been used as an alternative tool in treating refractary intermittent allergic rhinitis.
Material and methods: we conducted a prospective study on 50 patients with a history of at least 2 years of moderate to severe allergic rhinitis that was not controlled by common antiallergic drugs. The control group was composed out of 38 patients affected by nonallergic noninfectious rhinitis (negative skin prick tests). Each nasal cavity was illuminated 3 times a week, three weeks consecutively with the same device (Rhinolight III, Szeged, Hungary). Signs and symptoms of AR were scored before and after treatment. The phototherapy's efficacy was assesed by clinical findings (endoscopic exam, anterior rhinomanometry), Total Nasal Symptoms Score (TNSS) and the Rhinoconjunctivitis Quality of Life Questionaire (RQLQ). Nasal lavages and citologic exam were performed as well. Data were analyzed using the SPPS 13 for Windows.
Results: There were 30 (60%) patients affected by persistent AR and 20 with intermittent AR. 36 (72%) had a severe form, the rest of fourteen a moderate degree. Rhinophototherapy was well tolerated (less than 7% reported adverse side effects) and resulted as a significant improvement of sneezing ($p<0.06$), rhinoreea ($p<0.013$), nasal itching ($p<0.07$) and TNSS ($p<0.001$). The TNSS and the score for sneezing also improved significantly in the control group. Anterior rhinomanometry shows significant improvement of nasal obstruction in the study group. When the previous and after treatment data were compared, statistically significant differencies were found in all quality of life variables ($p<0.03$). In the nasal lavage, phototherapy significantly reduced the number of eosinophils and the level of eosinophilic cathionic protein (ECP).
Conclusions: these results suggest that rhinophototherapy is an effective method to relieve AR symptoms and has a positive effect on the patients'quality of life. Further studies are needed to assess its long term results; the very good results obtained in the control group might suggest that some of our skin-prick negative patients were affected by local allergic rhinitis – the new clinical entity. The non-DNA damage effect on nasal mucosa (confirmed by long-term studies) and our good results, encourage us to recommend phototherapy as an alternative for treating uncontrolled allergic rhinitis.

FESS-7

Bacterial biofilms in otolaryngology

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Introduction: Bacterial biofilm is a three-dimensional structure made of aggregates of bacterial cells (microcolonies) and the extra cellular matrix released by them, adhering to organic and inorganic surfaces. It is estimated that 99% of all bacteria exist in biofilms, and only 1% live in a free-floating or planktonic state at any given time. The aim of the study was to assess the existence of bacterial biofilm on the mucosa surfaces of patients undergoing surgery for chronic rhinosinusitis, chronic or recurrent tonsillitis, OMS and adenoid hyperplasia.
Material and methods: All patients were underwent surgical treatment. Samples of tissues have been taken from paranasal sinuses. Tonsils were analyzed in the whole. In cases of secretory otitis media tympanostomy tubes were taken. Taken samples were prepared and examined with a scanning electron microscope (SEM). The images were then compared with the available database of the biofilm images.
Results: Using SEM morphologic criteria, based on the morphological features of biofilms presented in available references, (e.g. three-dimensional structure, presence of bacterial colonies, water ducts, and adherence to mucous membrane), the biofilms were identified in the study material. A bacteriological examination of smears taking from samples, revealed the presence of various types of bacteria.
Conclusions: It is supposed that bacterial biofilms perform an essential role in the pathogenesis of many chronic diseases in otolaryngology. One may speculate that, the presence of biofilms in patients with chronic rhinosinusitis could induce the co-occurrence of such illnesses as nasal polyps, bronchial asthma, aspirin-induced asthma or a NSAIDs allergy. In order to evaluate better the role of biofilms in chronic rhinosinusitis, it seems justified to extend the research to a larger group of patients and a control group.

FESS-8

Pedicled septal mucosal flap In repair of iatrogenic csf leaks caused by tearing of middle turbinate

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Septal mucosal flaps are well known augmentation for large skull base defects reconstruction. It is less likely to use them in iatrogenic csf leak reconstruction as in case of presence of preserved middle turbinate. We present three cases of iatrogenic csf leak in which the reason of damage was extensive tearing of the

middle turbinate with its final partial or total removal. Patients were 15,45,63 years old ,operated on between 2008–2011. The youngest patient experienced 5 episodes of meningitis after nasal surgery with subsequent unsuccesfull repair of csf leak.One patient was admitted for repair with massive rhinorhea which occurred right away after tamponade removal following nasal surgery.The third patient has had large defect with small encephalocele following radical inverted papilloma surgery. In first two patients defects were on the left side,as in third the defect was on the right side.During surgery the mucosa was carefully removed from around the area of the osseous defects which were multifocal,cleft like in two patients,whereas in one patient the defect was single about 1cm in its largest diameter.The following technique was used: in two patients with cleft –like osseous deficits the small fat pieces of fat were used to plug the defects following tachoseal .In a patient with larger defect the dura was elevated from around the margins and the Tachocomb was palced between the bone and the dura.In all cases pedicled mucosal septal flap was used to cover the reconstructed area.All patients were free from rhinorrhea right after surgery and remain asymptomatic in 3 to ½ year follow up.

FESS-9

Expression of Th1 and Th2-typed cytokines and its significance in nasal polyps

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Objective: Although nasal polyposis is a chronic inflammatory disease of the nasal mucous, the pathogenesis of nasal polyps is still not entirely known. The aim of the present study was to evaluate the possible role of cytokines in pathophysiology and treatment of nasal polyps.
Method: The expressions of Th1-typed cytokines IFN-gamma, IL-2 and Th2-typed cytokines IL-4, IL-13, TNF-alpha were investigated with enzyme-linked immune sorbent assay (ELISA) in 25 patients with nasal polyps.
Results: We found a significant upregulation of Th2-typed cytokines IL-4, IL-13 and TNF-alpha in nasal polyps compared with normal nasal mucous, especially IL-4 and TNF-alpha (4 times and 3,8 times higher than normal mucous respectively). The expression of Th1-typed cytokines IFN-gamma, IL-2, IL-12 decreased after treatment with local glucocorticoid. Also in patients with recurrent polyposis the expression of INF-gamma was significantly lower (p=0.05). Although we did not observe any obvious change in Th1-typed cytokines expression, the levels of Th2-typed cytokines decreased significantly.
Conclusions: The upregulation of Th2-typed cytokines such as IL-4, Il-13 and TNF-alpha may play an important role in the pathophysiology of nasal polyps. Therefore Th2-typed cytokines can be expected as a treatment target to nasal polyps.