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Presentation Abstracts

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Presentation Abstracts

PSYCHOACOUSTICS AND AUDITORY PROSTHESES

Brian C.J. Moore
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Most sensorineural hearing loss is associated with several changes in the perception of sound, including: (1) loudness recruitment; (2) reduced frequency selectivity; (3) distorted/noisy sensations; (4) impaired sound localization and spatial perception. Changes (1) and (2) probably result mainly from loss of function of outer hair cells, which are crucial for the operation of the "active mechanism" in the cochlea. Changes (3) and (4) probably result mainly from reduced function of inner hair cells (IHCs), synapses and neurons in the auditory nerve. This may also result in reduced sensitivity to the temporal fine structure of sounds. In extreme cases, the IHCs/synapses/neurons may be almost completely non-functional over a certain region of the cochlea, giving a "dead region". When a dead region is extensive, a cochlear implant may be more effective than a hearing aid.

Each change in perception has consequences for the way that hearing aids are designed and fitted. Multi-channel amplitude compression is designed and adjusted to compensate for the effects of threshold elevation and loudness recruitment, with the goal of making weak sounds audible and preventing intense sounds from being uncomfortably loud. The gain is usually reduced at low frequencies to prevent the masking of medium and high frequencies by low frequencies that can result from reduced frequency selectivity. There is no direct method of compensating for changes (3) and (4), but directional microphones and preservation or enhancement of binaural cues may be beneficial. Amplification of frequencies well inside an extensive dead region is usually not beneficial.

KEYWORDS: Hearing aids, frequency selectivity, loudness recruitment, dead region, temporal fine structure, binaural hearing

LONG-TERM EXPOSURE TO MODERATE LEVEL SOUND INDUCES LONG-LASTING CHANGES IN CORTEX THAT MAY AFFECT SPEECH UNDERSTANDING

Jos J. Eggermont, PhD, FRSC
Emeritus Professor in Physiology and Pharmacology, and Psychology, University of Calgary Calgary, Alberta, Canada

Long-term changes in adult cat auditory cortex can be induced by long-term (~6 weeks) exposure to moderate sound levels (around 70 dB SPL). These changes include response suppression in the exposure frequency range, enhanced responses above and below this range, increased neural synchrony, and reorganization of the cortical tonotopic map. All this occurs in the absence of changes in tone-evoked ABRs and in DPOAEs. Several aspects of these cortical changes also remain impaired over the long-term by an interrupted (12 h on–12 h off) exposure to a moderate-level acoustic environment.

The increases in driven and spontaneous firing rates that occur at the edges of the exposure frequency band are reflecting increased central gain for these frequency regions. Combined with the reduced gain in the exposed frequency region, this will have a serious effect on the representation of complex sounds such as speech with frequency ranges that extend above and below the exposure range—potentially leading to problems with speech intelligibility.

Changes in cortical neuron thresholds and spontaneous firing rates induced by continuous and intermittent exposure to the same frequency band and level are reversible after a relatively long period (12 weeks) of quiet recovery. However, neural synchrony and in the tonotopic maps did not return to normal after this long recovery period. Although it is presently unclear how these persistent changes affect behavioral measures such as speech understanding, this could have serious implications for people exposed to noisy work/living places, even at levels considerably below those presently considered unacceptable.

CROSSMODAL PLASTICITY IN COCHLEAR IMPLANTED DEAF PATIENTS

Pascal Barone[1], Kuzma Strelnikov[1], Olivier Deguine[1,2]
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The cochlear implant is a neuroprosthesis that allows profoundly postlingual deaf patients to recover speech intelligibility through long-term adaptive processes to build coherent percepts from the coarse information delivered by the implant. Further CI users preserve a striking speech reading ability acquired during the period of deafness which is associated to abnormal crossmodal activations in regions normally devoted to processing auditory information.

Because the strategy adapted by CI users for speech comprehension is linked to the cortical crossmodal plasticity our approach was based on searching for brain regions whom the level activity at time of implantation is correlated with the level of auditory recovery several months later. Using Pet scan brain imaging we analysed the correlation between brain activity at time of implantation and auditory word perception scores 6 months later. Correlations were observed in a set of areas outside the auditory cortex with the highest correlation in the right visual occipital cortex. Other correlated areas included the posterior temporal cortex known for audiovisual integration and the left inferior frontal area. These results show that the initial high activity of the visual cortex provides the best potential to favour auditory recuperation.

In a general perspective, this study suggests the existence of neural facilitation mechanisms that link both visual and auditory sensory modalities. Such cooperation may be a reflection of the multisensory nature of speech processing, it supports the large set of data demonstrating an important role of visual input for speech comprehension in cochlear implanted postlingual deaf patients.

LEARNING-INDUCED PLASTICITY IN SPATIAL HEARING

Andrew J. King
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One of the most important functions of the auditory system is to help determine the whereabouts of objects and events in the surrounding environment. This ability relies on the processing of spatial cues generated by the way sounds interact with the head and external ears. The auditory system is able to compensate for changes in the relationship between spatial cue values and sound source direction that result from a partial loss of hearing in one ear, which enables accurate sound localization to be maintained under different hearing conditions. Adaptation to altered auditory spatial cues is possible both during development, when the cue values corresponding to different directions in space change naturally as the head and ears grow, and in later life. Studies in ferrets have shown that auditory spatial learning is disrupted by inactivation of primary or non-primary regions of the auditory cortex and by the loss of cholinergic neurons in the basal forebrain that target the cortex. The ability to compensate for unilateral hearing loss relies on multiple forms of plasticity: a context specific reweighting of different cues according to how reliable they are – effectively changing the strategy used to localize sound – as well as adaptive shifts in neuronal sensitivity to the altered binaural cues.

PLASTICITY IN THE AUDITORY SYSTEM OF CONGENITALLY DEAF WHITE CATS

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To investigate mechanisms of neuronal plasticity, experiments are required that allow to investigate function of individual neurons at different levels of the auditory system and also the underlying structural changes following deafness and cochlear implantation. Previous studies have shown that chronic stimulation through cochlear implants in congenitally deaf cats leads to cortical maturation that match imaging data from human subjects (Kral and Sharma, 2012, Trends Neurosci). Such intramodal plasticity shows sensitive periods. One possible measure of intramodal (auditory) plasticity is the reorganization of aural preference in the brain following monaural cochlear implants (Kral et al., 2013, Brain), showing a sensitive period of <4.2 months in cats. Binaural properties of cortical neurons demonstrate a substantial reduction of representation of binaural cues following developmental unilateral hearing (Kral et al., 2015, Audiol Neurootol). Consequently, intramodal functional maturation requires auditory experience. Additional to reduced synaptic plasticity, loss of acuity in cortical feature representation, deficits in integrative function of the cortical column and deficits in corticocortical interactions, particularly top-down interactions, close the sensitive periods (Kral 2013, Neuroscience). Cross-modal or hetermodal plasticity could further recruit auditory resources for non-auditory tasks. Despite of cross-modal reorganization in some auditory cortex (Lomber et al., 2010, Nat Neurosci), the absence of such effects in other areas (ibid.) and the weak underlying reorganization of corticortical connections (Barone et al., 2013, PLoS One) indicates that this effect only moderately limits auditory processing capacity. Electrophysiological recordings in the dorsal auditory cortex of congenitally deaf cats demonstrate that the cross-modally reorganized secondary auditory areas maintain a predominance of dormant auditory inputs additional to moderate cross-modal reorganization.

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CROSSMODAL PLASTICITY IN DEAF AUDITORY CORTEX MEDIATES ENHANCED FACE PERCEPTION IN THE CONGENITALLY DEAF

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In the deaf, it has been proposed that "deaf" auditory cortex may be recruited to perform visual functions. To test this hypothesis we examined the abilities of adult congenitally deaf cats (n=4) and hearing cats (n=4) on a battery of visual tasks to define visual functions involved in crossmodal compensation. The animals were tested on their capabilities to learn seven pattern or object discriminations: simple patterns, complex patterns, simple objects, junk objects, natural scenes, and faces (human & conspecific). Both deaf and hearing cats learned to discriminate simple patterns, complex patterns, simple objects, junk objects, and natural scenes at similar rates. However, deaf cats were faster at learning (errors to criterion) both the human and conspecific faces compared to hearing cats. These results show that deaf subjects possess enhanced visual abilities. Next, we examined if crossmodal reorganization in auditory cortex may mediate the

superior visual capabilities of the deaf. To accomplish this, we bilaterally placed cooling loops on A1, A2, the temporal auditory field (TAF), and insular cortex (area IN) to permit their individual deactivation. Bilateral deactivation of A1, A2, or area IN, did not alter learning rates for either the human and conspecific faces. However, bilateral deactivation of TAF resulted in the elimination of the enhanced face (both conspecific and human) discrimination learning capabilities of the deaf cats and resulted in performance similar to hearing cats. Overall, our results show that enhanced visual cognition in deaf cats is caused by crossmodal reorganization within "deaf" auditory cortex.

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SPEECH INTELLIGIBILITY MODELS IN AUDIOLOGICAL DIAGNOSTICS

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Speech intelligibility is influenced by the speech and noise properties as well as by the listener's auditory and cognitive processing. The complex relations between these factors make the interpretation of speech intelligibility data and consequently the choice of rehabilitation strategies difficult. Speech intelligibility models can help to overcome this problem as they make quantitative predictions of speech intelligibility which are typically based on the signal properties and the peripheral dysfunctions of the auditory system as, for instance, described by the hearing loss. Consequently, if model predictions deviate from the observed speech intelligibility of an individual patient this can indicate a dysfunction of central auditory processing or cognitive processing. For practical reasons such models can be included directly in the measurement software and support audiological diagnostics.

This talk shows comparisons between predicted and observed intelligibility for large data bases. The speech reception thresholds (SRTs) in quiet can be predicted nearly perfectly by the hearing loss. The SRTs in steady state noise as well as in modulated noise are influenced by further factors.

A binaural speech intelligibility model, which describes the consequence of a spatial separation of target speech and interferers, is able to explain the complex interaction between hearing loss and acoustical condition with respect to the SRT. In this way it is partly possible to disentangle the influence of audibility from binaural processing and from cognitive processing.

KEYWORDS: Speech intelligibility, hearing loss, noise, binaural, cognitive

EVALUATION OF SPEECH-IN-NOISE MEASUREMENTS AND AUDIOLOGICAL PERFORMANCE IN MIDDLE EAR IMPLANTS AND HEARING AID

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It is possible to encounter some problems in the use of conventional hearing aids in the presence of middle ear disease and in the patients whose hearing can not be restored by surgical means. Placement of active middle ear implants to the middle ear windows is one of the alternative approaches. In this study, we aimed to campare the performance of the active middle ear implants and conventional hearing aids in an attempt to assess the affect of active middle ear implant surgery on Shearing. Initially, 21 patients who were using a conventional hearing aid for at least 3 months were evaluated regarding their auditory performance. Then, active middle eare implantation surgery was performed on one of the middle ear windows in these patients. Amplification and quality of life assessments were performed using IO-IHA inventory after both hearing aid and active middle ear implant applications. There was no statistically significant difference between both amplification methods regarding the functional gain at the frequencies 125, 250 and 500 Hz or the avearege values at low frequencies ($p>0.05$). Active middle ear implants yielded a significantly better functional gain campared to the conventional hearing aids at the high frequencies as well as in the pure tone averages at the frequencies 1000, 2000, 4000, 6000 and 8000 Hz (speech frequencies) ($p<0.05$). There was no significant difference between both amplification methods in terms of speech discrimination in silence or in an environment with a S/N ratio 5 ($p>0.05$). On quality of life and amplification satisfaction evaluation performed according to IO-IHA inventroy, benefit/effectiveness, social acceptance and total scores were beter with the active middle ear implants than the hearing aids ($p<0.05$).

WIDEBAND ACOUSTIC IMMITTANCE OUTCOME IN NORMAL INDIVIDUALS AND INDIVIDUALS WITH DIFFERENT MIDDLE EAR PATHOLOGIES

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As Wideband Tympanometry gains popularity, it is essential to understand the impact of different middle ear pathologies on Absorbance patterns. The purpose of this talk is to cover the general principles of reflectance techniques and examine absorbance patterns in various middle ear pathologies. Absorbance results in cases of otitis media with effusion, negative middle ear pressure, otosclerosis, ossicular discontinuity, rheumatoid arthritis, and ear drum perforation will be compared to age-appropriate normative data. Where applicable, absorbance patterns obtained at ambient pressure as well as pressurized mode (Wideband Tympanometry) will be reviewed.

Learning Objectives

- Explain Wideband Acoustic Immittance (WAI) and its similarities and differences to conventional tymanometry.
- Analyze WAI patterns in normal and different middle ear pathologies.
- Differentiate WAI patterns between different age groups and different middle ear pathologies.
- Define absorbance, reflectance, and transmittance.
- Examine WAI outcomes in normal and different middle ear pathologies.
- Understand the pros and cons of WAI in assessment of middle ear function.

THE INTERPRETATION OF SPEECH-IN-NOISE MEASUREMENTS

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Speech-in-noise-measurements are important in clinical practice and for research purposes. The results of these measurements are often described in terms of the speech reception threshold (i.e., the signal-to-noise ratio corresponding to 50% correct recognition) or SNR loss. It can be demonstrated that the slope of the speech recognition functions for hearing-impaired listeners always decreases with hearing loss. Consequently, the amount of SNR loss depends on the target point chosen, the type of speech material and the scoring method. Thus, the interpretation of results from speech-in-noise measurements is far from straightforward. When considering fluctuating noise, the interpretation of data is even more complex. It will be shown that the fluctuating masker benefit (i.e., improvement in SNR when using fluctuating noise instead of steady-state noise) must be reduced, or even negative, for higher SNRs for normal-hearing listeners. Much of the reduction in FMB for hearing-impaired listeners can be attributed to the higher SRTs in steady-state noise for these listeners. To interpret speech-in-noise measurements correctly it is essential to know the exact speech recognition function in steady-state noise for normal-hearing listeners and to know the SRT in fluctuating noise as a function of the SRT in steady-state noise for normal-hearing listeners. These functions need to be separately determined for each combination of fluctuating masker, speech material and transducer.

STRUCTURED SESSIONS: INDICATION CRITERIA FOR HEARING AIDS VS. IMPLANTABLE HEARING DEVICES

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Rapid scientific and technological progress over the past decades has boosted our possibilities to treat hearing loss. Today, almost all kinds and grades of hearing loss can be supplied with some sort of hearing device. While in earlier days it was thought that the different types of hearing devices – hearing aids and hearing implants – serve different types and grades of hearing loss, this view now turns out as too simplistic. The continuous refinement of hearing aid technology has extended the indication criteria for hearing aids, so that today there is some "indication overlap" between them and hearing implants. On the contrary, also hearing implants have been substantially improved and can be adapted to a variety of specific personal needs.

Questions and problems arising from this overlap of indication criteria, including possible strategies for decision making, will be discussed by a round of European experts in this structured session.

KEYWORDS: Indication criteria, hearing aids, implantable hearing devices

FROM HEARING WITH HEARING AIDS TO HEARING WITH COCHLEAR IMPLANTS

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With the expansion of the criteria for cochlear implantation to include patients with more residual hearing , the professional counseling of candidates to become a CI user or to stay with Hearing Aids become very challenging and complex, especially in cases that the audiological indications are unequivocal. This is true also in cases of patients with bimodal hearing (CI/HA) seeking hearing with bilateral CIs (CI/CI). The current studies focused on two groups, one group of experimental adult CI/HA users, who converted to CI/CI and the other, consisted of, CI/HA adults who were tested with individual fitted with more powerful hearing aid (Personal Amplifier-PA) –CI/PA. Tests included auditory functions of bilateral-binaural hearing, low frequency tasks, and questionnaires. In addition real ear measurements of the HA and PA were also performed. Results showed that CI/CI hearing was significantly better for speech lateralization and for perception of speech in noise, but CI/HA was better that CI/CI for perception of natural prosody speech and of speech with flattened fundamental frequency (F0) contour. In significant cases, PA added significant contribution as compared to HA. Surprisingly, in some cases no association was found between the real-ear acoustic measurements and the added benefit of PA. Thus, counseling regarding contralateral implantation CI/HA users should carefully consider individual functional needs, long period of well fitted powerful HA, aided and unaided speech articulation discrimination tests, expectations, the trade –off between gaining improved high frequency hearing but losing of low-frequency information and finally, the subjective benefit from the current hearing aid.

VIBRANT SOUNDBRIDGE APPLICATION TO MIDDLE EAR WINDOWS VERSUS CONVENTIONAL HEARING AIDS: A COMPARATIVE STUDY BASED ON INTERNATIONAL OUTCOME INVENTORY FOR HEARING AIDS

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The objective was to compare the outcomes of satisfaction of the patients who used hearing aids preceding the vibrant sound bridge (VSB) application on middle ear windows (14 oval window and 5 round window). Nineteen adult patients with conductive or mixed hearing loss were included in the study. All patients used behind the ear hearing aids on the site which was selected for VSB application. The patients used hearing aids for at least 3 months before the VSB

operation. The floating mass transducer (FMT) was placed on one of the middle ear windows (oval or round) in VSB operation. The patients were evaluated with International Outcome Inventory for Hearing Aids (IOI-HA) preoperatively after at least 3 months trial of conventional hearing aid and postoperatively after 3 months use of VSB. No perioperative problem was encountered. The total score of IOI-HA was significantly higher with VSB compared with conventional hearing aids ($p<0.05$). No statistically significant difference was found between the daily use, residual activity limitations, satisfaction, impact on others, quality of life between middle ear implant and hearing aid ($p>0.05$). The IOI-HA scores were significantly higher with the middle ear implant than the conventional hearing aid regarding benefit and residual participation restrictions ($p<0.05$). Although the scores for quality of life assessment was similar between VSB and hearing aid use, there was a superiority of VSB in terms of benefit and residual participation restrictions as well as overall IOI-HA scores as the FMT was placed on one of the middle ear windows.

COCHLEAR IMPLANTATION IN SUBJECTS WITH SUBSTANTIAL RESIDUAL HEARING

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During the last decade it turned out that normal hearing on the contralateral side is not a contraindication for cochlear implantation and for each ear the optimum treatment has to be chosen. Concerning the ear which will be implanted, cochlear implants are required when conventional hearing aids do not allow for sufficient speech understanding. Usually, extensive hearing aid trials with hearing aids of different types and quality were performed before cochlear implantation takes place. Until now, no clear criteria exist, which enables to decide whether hearing aids or cochlear implants will provide better speech understanding. Therefore, analyzing outcome data for hearing aids in subjects with different degrees of sensorineural hearing losses are necessary.

Audiometric measurements of 185 sensorineural hearing-impaired subjects were evaluated retrospectively. The data were collected as a part of clinical routine for hearing aid performance assessment. All subjects had been supplied with hearing aids and had at least 3 months experience. Speech perception with hearing aids varied even for very similar puretone thresholds. With puretone thresholds above 50 dB the average recognition is worse with hearing aids than with cochlear implants.

By combining information from speech and puretone audiometry hearing aid performance can be estimated. Therefore, an audiometric criterion can be derived which indicates that cochlear implantation is superior to acoustic amplification. This criterion is supported by comparing hearing related quality of life with conventional hearing aids and with cochlear implants as determined by several questionnaires (Oldenburg Inventory, Nijmegen Cochlear implant questionnaire, and Hearing Implant Sound Quality Index).

KEYWORDS: Candidacy, cochlear implant, hearing aids, speech perception

INDICATION CRITERIA FOR HEARING AIDS VS. IMPLANTABLE HEARING DEVICES

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One of the commonest causes of sensory disability are deafness and hearing impairment. In 2013, WHO released estimates of prevalence of hearing loss. Globally, 360 million people live with a disabling hearing loss. The majority of cases can be remedied through early diagnosis and one of the proven interventions.

Remarkable progress has been made in the last three decades in improving therapies for severe hearing impairment, particularly as the result of technological and medical advances in implantable hearing devices such as cochlear and middle ear implants. The past decade has also seen major advances in hearing aid technology and performance. Today's hearing aids offer higher fidelity of sound, greater overall amplification, directional sound detection, and frequency-specific amplification compared to their predecessors. Consequently, there is a choice of an appropriate electric, acoustic or electro-acoustic stimulation which allows to improve auditory abilities and to return both pre- and postlingually deaf patients to the world of sounds. As the current candidacy criteria for different types of auditory implants overlap with the criteria for hearing aids, they are going to be thoroughly discussed in the paper.

INVENTORY, OBSERVATIONS AND ANALYSIS OF AUDIOLOGY EDUCATION PROGRAMS IN EUROPE

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Over the last three years, EFAS has made an overview of audiology education programs in Europe. With the inputs of many EFAS representatives and local coordinators of the teaching programs, detailed information was received about more than 130 teaching programs in more than 20 European countries.

In a first step, these programs have been specified according to 17 dimensions (e.g. duration of the program, degree to be earned, contact details, website, profile and strengths of the program). The situation in the different European countries is very diverse. Some countries don't have any specific audiology education program available, others offer bachelor and master programs in Audiology (e.g. Sweden, Denmark, Belgium, Portugal, Germany), some focus on training in medical audiology for physicians (e.g. Finland and France), etc.

In a next step, the bachelor and master programs have been characterized in more detail. The specific courses of the individual programs were classified in a number of components (e.g. basic & applied physics, anatomy & physiology, research methodology). This more detailed characterization of the inventory helps to detect similarities and differences between the various European programs. Some programs are very technically oriented, while others are more clinically oriented. Audiology is sometimes the main focus, while it is also quite often combined with other topics like speech and language disorders.

The inventory and more detailed classification of audiology teaching programs may facilitate collaboration and exchange. Moreover, it may help to identify a minimum common denominator or a core program.

KEYWORDS: Audiology education, inventory, exchange

EDUCATION IN AUDIOLOGY

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The audiology education in Turkey was initiated in the year 1968 at the Hacettepe University on the master level programme. And in the year 1989, the programme was changed into Audiology and Speech Pathology. Bachelor degree programme was started in the year 2011 within the body of Health Sciences Faculty of Hacettepe University. The bachelor's degree programme is completed in a period of 4 academic years and our graduates assume the title of Audiologist. In order to be admitted to the Audiology Department, the candidates are obliged to finish the high school and to obtain required points in the MF-3 scoring category of the University Entrance Exam in Turkey. To graduate from the Audiology Department, all students are obliged to complete 240 ECTS or 128 National credits successfully. To finish Audiology and Speech Pathology Master Programme, all students have to complete 120 ECTS successfully. To register to Audiology and Speech Pathology doctorate programme, candidates should have completed the Master Degree from Audiology and Speech Pathology Programme. To finish the Audiology and Speech Pathology Doctorate Programme, all students have to complete 240 ECTS (8 semester) successfully and to succeed Doctorate Proficiency. In the presentation, general information regarding the Audiology education in Turkey will be given.

Hacettepe University Post Graduate regulations that are published at:
http://www.hacettepe.edu.tr/Eklenti/1235_
hulisansustuogrvesinavyonetmelik are followed.

KEYWORDS: Education, audiology, ECTS

ELECTROPHYSIOLOGIC EVALUATION OF THE VESTIBULAR SYSTEM FOR PERIPHERIC VESTIBULAR DISEASES

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There are several tests fort he evaluation of the vestibular system. All these tests are based on different parameters that measures the function of the vestibular end organ and/or superior or inferior branches of the vestibular nerve. The data obtained from these tests complement or confirm the results of each other.

Vestibular evoked myogenic potantials (cVEMP, oVEMP) are electrophysiological tests that use the vestibulo-colic or vestibule ocular pathways to evaluate the vestibular system. These non-invasive tests monitor the functions of inferior and superior vestibular nerves. However, the rare pathologies of saccule and utricule may also be diagnosed by cVEMP and oVEMP.

The data obtained from VNG (Videonystagmographic recordings of vestibulo ocular reflex and visual vestibular ocular reflex) gives information related to the pathologies of semicircular canals (SCC), superior and inferior nerves. Caloric test is a low frequency stimulation which stimulates the lateral SCC.

VHIT (Video Head Impulse Test) is a rather new test. Enables to evaluate each SSC seperately and provide information about the superior and inferior vestibular nerves. Right and left vestibular nerves are evaluated simultaneously and in a short time. VHIT differs from the caloric test by stimulating both inferior and superior nerves with high frequency stimulation.

This presentation aims to demonstrate the role of the listed tests in the diagnosis of peripheral vestibular diseases together with the results of representative cases.

ADVANCES IN TINNITUS AND HYPERACUSIS TREATMENTS

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Tinnitus and Hyperacusis can be devastating in both adults in children, causing emotional, hearing, sleep and concentration problems. Questionnaires such as the new Tinnitus Primary Function Questionnaire are helpful for treatment focused on reducing reactions to tinnitus. A Hyperacusis Disability and Handicap Scale is also available. There are no medications or supplements that have been shown to reduce hyperacusis or tinnitus. However, several counseling and sound therapies have been shown to reduce reactions. Loudness, Annoyance, Fear and Pain Hyperacusis can be treated with low-level sound and with successive-approximation strategies. We utilize a picture-based Tinnitus Activities Treatment. For decades, the use of electricity presented to the cochlea has been shown to reduce tinnitus in some, and there are ongoing trials to suppress tinnitus in the cochlea and in the brain. Magnetic stimulation of the brain can also suppress tinnitus, but its clinical application is uncertain. A new trial using Vagus Nerve Stimulation paired with tones is underway for tinnitus. Finally, there is now a greater appreciation that there are different subgroups of tinnitus and hyperacousis patients, and the careful selection of subgroups is now being applied to new drug trials.

THE VIDEO HEAD IMPULSE (vHIT) IN CHILDREN – INITIAL EXPERIENCES IN A TERTIARY CENTRE

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INTRODUCTION: Since the discovery of the vHIT in 2009 by McDougal et. al, objective quantification of high frequency angular acceleration leading to the vestibulo ocular reflex (VOR) sensed by the semicircular canals has ushered in a new era in vestibulometry. Currently, this has found wide acceptance across the globe mainly in the adult population. The vHIT is also used in the paediatric population but there is no published data as yet. This study is the first study of its kind looking into the use of vHIT in children in a tertiary centre for paediatric audiovestibular medicine and audiology.

OBJECTIVE: The objective was to obtain quantified measures of high frequency vestibular information in a group of children in order to diagnose vestibular weakness for angular acceleration and analyse real time covert and overt saccades, gain asymmetry and gain in the VOR in bilateral semicircular function.

PATIENTS and METHODS: The study was a descriptive study with a cohort of 20 children presenting with either hearing problems or balance problems on their own or with both in Alder Hey Hospital which is a tertiary centre for paediatric audiovestibular medicine in Liverpool, UK. The patients were divided in two groups – Group 1: Those who presented with no balance problems which included normal and abnormal hearing and Group 2: Those who presented with balance problems including those who also had hearing problems. All children underwent a full paediatric vestibular test battery in addition to a full audiological test battery involving behavioural and objective audiometry. The children were then subjected to the vHIT while they focussed on a fixed target wearing the EyeSeeCam goggles from a distance of 1.5 metres, mainly in the lateral semicircular canal plane and in possible RALP (Right Posterior and Left Anterior) and LARP planes (Left anterior and Right Anterior) by 2 audiovestibular physicians achieving a high index of repeatability and reliability. The equipment used was the Interacoustics EyeSeeCam. The software computed the data as gain asymmetry, absolute gain, i.e. the ratio between head and eye movements (ideally 0.8 to 1) and generated visual observation of a lag in the eye movement when compared to the head movement as a covert or an overt catch up saccade generated in the direction opposite to the head movement. This data was analysed and meaningful conclusions drawn.

RESULTS: The age range of the children was between 4 years to 16 years with 13 girls and 7 boys; 8 in Group 1 and 12 in Group 2. There was noise in 6 children which made meaningful conclusions difficult whilst normal results were obtained in 3 in Group A and none in Group B. Overt saccades were more

COCHLEAR REIMPLANTATION AND REVISION SURGERY

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Altough cochlear implantation is a relatively safe surgical procedure some surgical problems can lead complications even in best hands. Device manufacturing problems or problems related with iife-time of implant may cause a non functioning device.In majority of these cases a revison surgery or reimplantation can solve the problem. However revision surgery and reimplantation may have spesific difficulties.In this speec 96 cases in which arevison surgery or reimplantation required among 1924 cases will retrospectively analysed and rules,hints and important points in revision surgery and reimplantation would be presented with short video-clips

ELECTROCOCHLEOGRAPHY

Bulent Satar
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In the presentation, mainly administration and applications of electrocochleography (ECoG) will be explained. ECoG is a recording method of early potentials of the cochlea and cochlear nerve in response to auditory stimuli. ECoG esentially focuses on first 4 msec of auditory response spectrum, even though some specific ECoG applications require looking at a later time span. There are 3 types of ECoG potentials: cochlear microphonic, summation potential and action potential. These potentials can be recorded via extra-tympanic electrode (ear canal electrode), tympanic membrane electrode or transtympanic needle electrode after delivering click or tone-burst stimuli. Response quaility has been found better in either tympanic membrane electrode or transtympanic needle electrode compared to extra-tympanic electrode. In standard electrode montage, while positive recording electrode is placed on tympanic membrane or the promontory (based on electrode of interest), negative disc electrode is attached to mastoid skin after cleaning the skin. Middle of the forehead skin is cleaned for gound disc electrode. Analysis time is adjusted to 5 msec for click-ECoG and to 20 msec for tone-ECoG. Stimulus rate is 9.3 or 11.4/ sec. A total of 200 or 500 stimuli are given. As high as 70-90 dB nHL of stimulus is delivered. Amplification is set to 50,000 or 100,000. Band-pass filter is kept between 3 Hz and 3,000 Hz. Polarity of click-stimuli is condensation, rarefaction or alternating.

ECoG can be used for diagnosis and monitoring of endolymphatic hydrops, identification of wave I and measuring I-V interpeak latency, objective measuring hearing thresholds, intra-operative monitoring of the cochlear and cochlear nerve functions and diagnosis of auditory neuropathy. Some clinical relevant examples will be presented.

OBJECIVE MEASUREMENTS IN NONORGANIC HEARING LOSS

Ufuk Derinsu
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Nonorganic hearing loss defines a hearing deficit indicated by hearing tests, however cannot be explained with any pathology. Generally primary reason of nonorganic hearing loss in adults is manipulations for financial gains whereas psychological gains in children.

In cases where hearing threshold estimation is necessary for legal processes, it is more beneficial in terms of both time and effort to make the estimation based on the auditory evoked potentials. Before beginning the test, any other possible pathologies –such as demantia- have to be considered. This way it becomes easier to select the appropriate evoked potentials among all of them.

HEARING IMPAIRMENT AND THE BRAIN: CROSS-MODAL REORGANIZATION AFTER COCHLEAR IMPLANTATION

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Hearing loss is traditionally related to disruptions at the periphery of the auditory system. In this talk I will emphasize the role of the central auditory system and the human cortex in particular. Research on cortical plasticity has identified that loss of sensory input can result in shrinkage of cortical representations, whereas exposure to relevant sensory events can increase representation zones and task performance. I will apply this cortical plasticity view to the case of rehabilitation of hearing loss with cochlear implants (CI). Using non-invasive electroencephalography (EEG) and functional near infrared spectroscopy (fNIRS) technologies we found a cross-modal, visual activation of the auditory cortex after CI adaptation. A deprivation-induced reorganization, if not fully reversible, may represent a maladaptive factor with respect to speech recognition with a CI. More recently we found evidence that this effect could be stimulus-related. Cross-modal activation of the auditory cortex may also support high-level visual processing, such as face recognition and lip reading. I will present ideas on how the role of cross-modal reorganization for CI outcome prediction could be determined.

DISSECTING VISUAL REINFORCEMENT AUDIOMETRY

Chris Halpin
Department of Audiology, Massachusetts Eye and Ear

This talk will explain the use of the Behavioral Audiometry Simulator (BAS), along with several other insights into the performance of Visual Reinforcement Audiometry (VRA). The BAS is a real time video simulator with which a student can test the live image of a 7 month old boy on his mother's lap using the VRA technique. BAS was developed after observations that students get experience with very few infants in their initial training and, when they do, they are often pushed aside by senior clinicians because they do not have enough skill to complete a test in the time available. This provides a rationale for an intermediate step where a student can test an admittedly easy infant until they are sufficiently experienced to begin to get real experience in the clinic. The BAS does not stop and teach. Video segments of a real infant behaving at full speed are shown continuously and only show reactions (for example a headturn) when the rules of VRA are followed. To succeed, the student must learn to present stimuli only when the infant is in a receptive state and to test conditioning by eliciting a conditioned headturn. The infant's thresholds, number of reinforce-stimulus pairings for conditioning, time limit and other variable are programmed by the teacher and are not known to the student. In this way many different VRA problem conditions can be encountered in an environment where mistakes do not affect the real care of an infant. Data from studies of the use of BAS will be shown as well as discussion of future uses as educational and skills validation technology. Several further observations will be briefly discussed regarding the details of interacting with infants (a personal space evaluation technique) and getting headphones on. The pitfalls of using monitored live voice in this technique will be shown. Finally, an alternate view of infant resting state goals will be discussed with the use of unusual states of boredom explored as a method to achieve the maximum effect in VRA. Hopefully, these topics will promote a discussion of both VRA technique and VRA training.

PAEDIATRIC VESTIBULAR ASSESSMENT – MAKING CLINICAL TESTING CHILD'S PLAY

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Children's balance development is an evolving process from the day they are born. A deficit in the functioning of any of the balance inputs may have an impact on the child's overall balance development. The consequences can be variable, from a delay in onset of walking to the experience of difficulties in situations where the functioning inputs are challenged. Other children can have acute intrusions on their balance system leading episodes of dizziness. This may be due to such conditions as enlarged vestibular aqueducts or migraine. A lot of resources are available for the assessment of balance in adults but balance issues in children are often not considered or assessed. This presentation will give a overview of the development of balance in children. I will also look at strategies to engage children in the assessment process. After all who doesn't like to play!

KEYWORDS: Paediatric, vestibular, imbalance

PRESCHOOL HEARING SCREENING: A VITAL LATE PHASE OF EARLY DETECTION

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Early childhood hearing loss is related to language disorders, academic delays, and disorders in psychosocial adjustment. Newborn and infant hearing screening has brought measurable improvement in developmental outcomes of early identified children, however there is a gap in detecting post-infancy onset hearing loss. The incidence of hearing loss in the preschool population varies in related reports, from 1.2%, to 11.9%. Screening hearing in the preschool years is emerging as a necessity, because it ensures intervention in the critical time before entry into the academic process. Preschool Hearing Detection (PHD) is a project testing hearing in preschool children (4.5-5.5 years of age) in Cyprus. PHD combines otoscopy, tympanometry, and pure tone audiometry, with tablet-based tone audiometry and speech audiometry. The Adaptive Auditory Speech Test (AAST, Coninx, 2006), consists of words presented in quiet and noise, in an adaptive procedure; the child has to choose the corresponding picture from a closed set. AAST has been adapted to Greek, and is presented via tablet PC, in order to assess feasibility, reliability, and validity of testing this population. Children are referred based on the

ASHA criteria for otoscopy, tympanometry, or pure tone screening. Referred children are evaluated for speech and language disorders, and academic performance. Results of the recommended evaluation and follow up are tracked up to six months after initial referral in order to determine final outcomes.

Preschol Hearing Screening in Cyprus

Cyprus Research Promotion Foundation

HEALTH/NEW PRODUCTS AND SERVICES/0311/50

KEYWORDS: Preschool, hearing, screening, speech audiometry, tone audiometry

COMPREHENSIVE PRE AND POSTOPERATIVE REHABILITATIVE EVALUATION TECHNIQUES FOR PEDIATRIC COCHLEAR IMPLANT USERS

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Cochlear implants are one of the most efficient applications of compensative devices to humans, especially when the young, deaf children is considered. In order to precise the early and late outcomes and building a follow up program based on these findings are crucial for attaining the best results. For that reason, considering priceless value of early intervention the critical methods and outcomes that need to be assessed before and after early pediatric cochlear implantation should be eleborated. The potential impact of this (re)habilitative intervention in early development and consequent life effects forces a critical appraisal of what outcomes are chosen to guide parental, clinical, academic and socioeconomic decisions. Current comprehensive evaluation approaches should match with individualized traits and needs but also exhibit reliable outcomes for comparing with the normative data.

KEYWORDS: Cochlear implants, assessment, hearing, pediatric, audiology

TECHNOLOGICAL ADVANCES IN SOUND-BASED APPROACHES TO TINNITUS TREATMENT

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The past decade has seen increased drive to comprehend chronic subjective tinnitus from the perspectives of improving both scientific understanding and clinical management. At the same time, there is significant interest and commercial investment in providing targeted and individualised approaches to care which incorporate novel sound-based technologies, with standard audiological and psychological strategies. Within our lab we have explored an experimental intervention based on frequency-discrimination training, while numerous other sound-based devices for tinnitus are already available as commercial products. Many of these interventions overtly claim to target the underlying neurological causes of tinnitus. In this talk, I briefly give a scientific appraisal of these claims. I conclude that although many of the recent technological innovations for individualised sound-based interventions make reference to central auditory mechanisms as a key underlying principle for their efficacy, there is insufficient evidence to strongly support those claims.

COST ACTION BM1306 : BETTER UNDERSTANDING THE HETEROGENEITY OF TINNITUS TO IMPROVE AND DEVELOP NEW TREATMENTS (TINNET)

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Tinnitus is a common condition that is characterised by sounds in the ears or head. Over 70 million people in Europe experience tinnitus, and for 7 million it creates a debilitating condition. In spite of its enormous socioeconomic relevance, research funding is limited. There are no standards for clinical management and treatments typically have low evidence levels. One of the problems is the heterogeneity of tinnitus. Both in experimental (pre-clinical) research and in clinical trials, many of the reported findings cannot be replicated. Many clinical trials fail to demonstrate a significant benefit, even if individual patients may improve.

The European Union has approved funding for a TINNET COST Action (2014-2018) to create a pan-European tinnitus research network whose overall aim is to better understand the heterogeneity of tinnitus. The TINNET strategy is to standardise and coordinate clinical, neuroimaging and genetic assessment of tinnitus patients and to aggregate data in a large-scale database in order to identify tinnitus subtypes and their neurobiological underpinnings. Presently, there are 26 participating countries and five working groups (WG):

- WG1: Defining clinical assessments of tinnitus patients according to common standards
- WG2: Managing data in a central database and identifying subtype candidates via meta-analysis.
- WG3: Developing standards for neuroimaging studies and probing the neurobiological entity of the defined subtypes by large-scale analyses of neuroimaging data.
- WG4: Identifying the involvement of genetic factors in the pathogenesis of the different subtypes of tinnitus
- WG5: Developing standards for outcome measurements in clinical trials and to facilitate central database management.

This new knowledge will be essential for developing effective treatment approaches, designing high-quality clinical investigations and speeding up the translation into marketable products.

DEVELOPMENT OF AUT00063, A SELECTIVE MODULATOR OF Kv3 ION CHANNELS FOR THE TREATMENT OF TINNITUS

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Kv3.1 channels are voltage-gated potassium channels that enable fast repolarization of the neuronal action potential, and are essential for the high-frequency, high-fidelity firing of neurons in the auditory brainstem and midbrain. Altered activity of these neurons has been implicated in the generation of tinnitus induced by noise exposure. Furthermore, loss of Kv3 channel function has been observed shortly after noise exposure, which may contribute to the maladaptive plasticity leading to the emergence of tinnitus. AUT00063 is a novel, selective modulator of Kv3.1 channels that has been investigated in a number of animal models of noise-induced hearing loss and tinnitus. In Long-Evans rats exposed to a unilateral 116 dB, 16 kHz octave-band noise for one hour, approximately half of the animals demonstrated deficits in auditory gap processing, consistent with the presence of tinnitus. Acute treatment with AUT00063 abolished evidence of tinnitus, without affecting the behavior of control animals or noise-exposed animals without tinnitus. In CBA/Ca mice exposed to 8-16 kHz noise at 105 dB SPL for two hours under anaesthesia, there was a significant increase in spontaneous activity of neurons in the inferior colliculus (IC) when recorded 4 weeks later. AUT00063 decreased IC excitability in noise-exposed animals, returning spontaneous rates to levels similar to those observed in control animals; no such effect was observed following injections of vehicle. These data support the evaluation of AUT00063 for the treatment of people with subjective, noise-related tinnitus.

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HIDDEN HEARING LOSS AND TINNITUS

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The physiological bases and perceptual consequences of 'hidden' noise-induced hearing loss

Dramatic results from animal experiments suggest that noise exposure can cause substantial damage to auditory nerve fibres (cochlear neuropathy) without affecting sensitivity to quiet sounds [Kujawa and Liberman, 2009, J. Neurosci. 29, 14077-14085]. The neuropathy seems to be selective for high-threshold auditory nerve fibres [Furman, Kujawa and Liberman, 2013, J. Neurophysiol. 110, 577-586]. Hence, although this "hidden" hearing loss may not be measurable by conventional pure tone audiometry, it may have consequences for the coding of sounds at moderate and high levels. There is also evidence that cochlear neuropathy is a cause of tinnitus. A recent study found that listeners with normal audiograms who experience tinnitus had a reduced amplitude of wave I of the electrophysiological auditory brainstem response (ABR) compared to audiogram-matched controls, suggesting that the tinnitus group had cochlear neuropathy [Schaette and McAlpine, 2011, J. Neurosci. 31, 13452-13457]. However, wave V of the ABR, reflecting activity in the rostral brainstem, was normal in the tinnitus group. The authors suggested that cochlear neuropathy triggers an increase in central neural "gain" as a form of homeostatic plasticity, effectively amplifying spontaneous neural activity and leading to the perception of tinnitus. We are conducting a large-scale multi-centre study to determine the causes and perceptual consequences of hidden hearing loss. Preliminary results will be presented, focusing on our investigation of the links

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BINAURAL CUE PRESERVATION IN NOISE REDUCTION ALGORITHMS FOR BINAURAL HEARING AIDS

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In a binaural hearing aid system, the hearing-impaired person is fitted with two hearing aids where the microphone signals of both hearing aids are shared, principally improving the performance compared to a monaural or bilateral system. The objective of a binaural speech enhancement algorithm is not only to selectively extract the target speaker and to suppress background noise, but also to preserve the auditory impression of the acoustic scene. This can be achieved by preserving the binaural cues, i.e. the interaural time difference (ITD), the interaural level difference (ILD) and the interaural coherence (IC), of all sources. These binaural cues play a major role in spatial awareness, i.e. for source localization and for determining the spaciousness of auditory objects, and are very important for speech intelligibility due to binaural unmasking.

For the binaural Minimum Variance Distortionless Response (MVDR) beamformer and the binaural Multi-channel Wiener filter (MWF) it has been shown that the binaural cues of the speech component are preserved but the binaural cues of the noise component are distorted, such that both components are perceived as coming from the speech direction, which is obviously undesired. To optimally benefit from binaural unmasking and to preserve the spatial impression, several extensions for the binaural MVDR beamformer and MWF have been recently proposed, which aim to also preserve the binaural cues of the residual noise component by including cue preservation terms in the binaural cost function. This presentation provides an overview of these extensions and presents the results of subjective listening experiments.

INSTRUMENTAL AND PERCEPTUAL ASSESSMENT OF BINAURAL SPEECH ENHANCEMENT ALGORITHMS FOR BILATERAL CI USERS

Regina Baumgärtel[1], Daniel Marquardt[1], Martin Krawczyk[1], Hongmei Hu[1], Christoph Völker[1], Stephan Ernst[1], Tobias Herzke[2], Graham Coleman[2], Kamil Adiloglu[2], Katrin Bomke[3], Karsten Plotz[3], Rainer Huber[2], Timo Gerkmann[1], Simon Doclo[1], Birger Kollmeier[1], Volker Hohmann[1], Mathias Dietz[1]

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Using current speech processors, Cochlear Implant (CI) users already reach up to 100% speech intelligibility in quiet. Listening in noisy environments however, still remains a challenge. The increasing supply of profoundly deaf patients with two independent implants (bilateral supply) already provides improved speech intelligibility in noise compared to unilateral supply.

In this study, the potential of binaural speech enhancement strategies to further improve speech intelligibility of bilaterally implanted CI users in noise was assessed. Instrumental measures as well as perceptual (listening) tests were used to evaluate 2 monaural and 6 binaural noise reduction schemes. All algorithms were implemented in the Master Hearing Aid framework and run online in real-time. 4 spatially distinct noise scenarios were created in a reverberant environment (T60 ≅ 1250 ms) using virtual acoustics. The Oldenburg matrix sentence test (Oldenburger Satztest OLSA) was used as speech material.

Several instrumental measures were applied to evaluate the algorithms' potential in improving speech intelligibility independent of inter-subject variability. Results from this instrumental evaluation demonstrate the ability of the tested algorithms to provide improvements in speech intelligibility as well as sound quality.

For the perceptual evaluation, speech reception thresholds (SRT50) were determined using a maximum likelihood adaptive measurement procedure. 8 bilaterally implanted CI subjects, using processors from 3 different manufacturers have participated in the evaluation. The results show substantial and significant improvements in perceptual speech reception threshold (SRT50) in reverberant, spatial testing conditions using the algorithms presented here.

BIMODAL STIMULATION: SOUND PROCESSING AND FITTING

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When a cochlear implant (CI) recipient has residual hearing in the non-implanted ear, it can be acoustically stimulated using a hearing aid together with the CI. This has been shown to be advantageous compared to only CI stimulation. However, while the two ears are stimulated, with current clinical devices bimodal listeners do not appear to use binaural cues, due to poor cue transmission by the devices and inappropriate fitting. We present two sound processing strategies to improve this: MEnS and SCORE bimodal.

The SCORE bimodal strategy aims to equalise loudness growth for both modalities using real-time application loudness models. SCORE was evaluated using loudness balancing, speech perception and sound source localisation experiments with 6 bimodal listeners. As SCORE was found not to interfere with speech perception and to improve loudness perception, it seems beneficial to implement it in clinical devices. To better individualise the loudness models, we are developing a method based on auditory steady state responses in the EEG to measure loudness growth functions with electrical and acoustical stimulation.

The MEnS strategy was developed to improve perception of interaural time differences (ITDs) with bimodal stimulation. It introduces temporal modulations on all stimulated electrodes, synchronously with modulations present in the acoustic signal. It was evaluated by measuring ITD sensitivity and extent of lateralisation. Compared to the ACE strategy, performance was significantly improved with just noticeable differences well within the physically relevant range.

The application of these two strategies could lead to improved sound source localisation and binaural unmasking.

THE ACOUSTIC FEEDBACK PROBLEM IN HEARING AIDS AND FEEDBACK CONTROL USING INAUDIBLE PROBE SIGNALS

Meng Guo, Jesper Jensen

Oticon A/S, Denmark

The acoustic feedback problem is one of the major problems that prevents the users to benefit from their hearing aids. Many solutions have been proposed to reduce the effect of the feedback problem. However, so far there is no proven solution that completely resolves the problem.

In this talk, we first revisit the acoustic feedback problem and existing signal processing solutions to combat feedback. We focus primarily on acoustic feedback cancellation using adaptive filters, which is the probably best solution to date.

Furthermore, we consider the so-called biased estimation problem, which is one of the most challenging problems for acoustic feedback cancellation systems. We briefly discuss some well-known approaches to minimize the effect of the biased estimation problem.

Finally, we present a new feedback cancellation system, which utilizes a probe signal which is added to the hearing aid receiver signal. In contrast to previous probe signal based solutions, this probe signal is constructed to be inaudible in the presence of the receiver signal; the proposed system significantly improves the feedback cancellation performance without introducing audible sound quality degradations.

In particular, we show that, whereas traditional and state-of-the-art acoustic feedback cancellation systems fail with significant sound distortions and howling as consequences, the new probe noise approach is able to remove feedback artifacts, e.g., caused by feedback path changes, in no more than a few hundred milliseconds.

CLUES AND PEARLS: THE EFFICIENCY OF DIAGNOSTIC TESTS FOR MENIERE'S DISEASE: c-oVEMP, DPOAE, PTA WITH GLYCEROL TEST

Özlem Konukseven
KTO Karatay Konya, Turkey

Differences in characteristics of patients with MD and the variable nature of progression makes it difficult to establish definitive interpretations. Hence, some effort has been made recently to investigate the correlation between the stages I-IV of MD and subjective and objective audio-vestibular tests with glycerol intake are highly interesting. Next to the cochlea, the saccule is the second most frequent site for hydrops formation, whose abnormalities can be explored with VEMP. Based on our experiences with studies results and the literature, this presentation is designed to answer questions « which audio-vestibuler tests should be applied reliably and how those tests are interpreted by comparing their diagnostic criteria according to stages I-IV of Meniere's disease.

WAYS TO IMPROVE SPEECH PERCEPTION PROBLEMS OF PATIENTS FITTED WITH COCHLEAR IMPLANT

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Nowadays, cochlear implantation is accepted as the most effective method for language development of children with bilateral profound hearing loss. However, it is not without problems. Children who use cochlear implants experience significant difficulty hearing speech in the presence of background noise, such as in the classroom. There is a need for clinicians to address not only communication needs of the children but also quality-of-life issues to optimize outcomes in children using cochlear implants.

For instance, after cochlear implantation, the intelligibility of speech produced by children deafened by cytomegalovirus had a wide range, varying from unintelligible speech to connected speech intelligible to all listeners. Concerns have been expressed with regard to suitability for cochlear implantation of children deafened by cytomegalovirus because of possible coexisting central disorders/learning difficulties.

There are several options in order to overcome speech perception problems. One of the option is to use two microphones, instead of one in the cochlear implant. Other options are to use bimodal hearing devices and assistive devices which improve speech intelligibility by increasing signal to noise ratio of cochlear implants or hearing aids especially in noisy environment.

By studying speech perception in normal listeners and hearing impaired subjects at noisy conditions, we should be able to provide guidance to cochlear implant engineers on what they need to add to future devices to better represent the finer details of sound. In this presentation, feasible options will be discussed.

EVALUATION OF THE DATA OF NEWBORN HEARING SCREENING (NHS) PROGRAMS IN TURKIYE

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After the first NHS program by the physiologic tests in the Rhode Island, USA (1989-1993), NIH Consensus Conference on Early Identification of Hearing Impairment in Infants and Young Children in 1993, and the European Consensus Statement on NHS in 1998 were issued.

NHS in Turkey has been started as hospital-based programs in 1996, and then, implemented in the major maternity hospitals. In 2004, Office of the Disabled Persons and Ministry of Health organized a pilot NHS study by the contribution and support of the four cardinal universities (Dokuz Eylül, Gazi, Hacettepe and Marmara Universities), in which audiology departments and audiology training programs have been implemented for years. In 2008, the pilot study was turned into a national NHS program of Directorate General for Maternal and Child Health and Family Planning, and at the end of 2011, 584 screening units were implemented all over the country. The coverage ratio was still around 88% of live births in 2013.

In this speech, we reviewed the published researches presenting the data of NHS programs in Turkey, and aimed to look for fails, referral rates, missed cases, the screening methods, and rate of the hearing loss. The data was evaluated to answer whether NHS programs in Turkey corresponds to three cardinal rules of JCIH: i) first screening test within the 1st month of life, ii) audilogic and medical evaluation for the failed cases before 3rd month of age, and iii) start intervention before 6 months of age.

CHILDHOOD VISION AND HEARING SCREENING - A DECISION-ANALYTIC, COST-EFFECTIVENESS MODEL PROVIDING EVIDENCE TO MODIFY, INTRODUCE OR DISINVEST SCREENING PROGRAMMES IN ALL EU-MEMBER STATES

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We aim to optimise the cost-effectiveness of vision and hearing screening in all candidate, associate and full EU-member states.

The research question is whether vision and hearing screening programmes can be optimised through cost-effectiveness modelling, taking differences between health-care systems and political, economic and societal contexts into account.

EU-directive 16620/11 invites member states to give priority to screening for hearing and vision disorders in children. Population-based vision and hearing screening programmes vary across EU-countries regarding tests used, age and frequency of testing, uptake, professions involved in screening, referral procedure and funding. Health equity demands their robust assessment and subsequent reallocation of resources.

Building on earlier experience with screening cost-effectiveness models and subsequent study of disinvestment of preverbal vision screening, the proposed study designs and populates a decision-analytic modelling framework which incorporates the net benefits of screening and measures the opportunity cost of such programmes.

Objectives

- Screening professionals, ophthalmologists, orthoptists, otolaryngologists and audiologists from all EU-countries report on screening programmes, health-care systems and their political, economic and societal contexts.

- Reported screening outcomes are evaluated for evidence for cost-effectiveness.

- Two unclear issues concerning screening for risk factors for amblyopia and prevalence of postneonatal hearing loss are evaluated separately.

- The cost-effectiveness model is constructed and populated with the reported and literature data.

- Inappropriate interventions, delayed provision of treatment, increased disease burden, health inequities and increased costs for health systems are identified.

- A TOOLKIT containing the cost-effectiveness model provides policymakers with evidence to modify, introduce or disinvest vision and hearing screening programmes in all EU-member states.

PERFORMANCE VARIABILITY IN CHILDREN WITH BILATERAL AND UNILATERAL HEARING IMPAIRMENT

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In many countries, congenital hearing impairment (HI) in children is detected soon after birth through neonatal hearing screening provided by the hospital and/or "child-supporting center". Despite early intervention children demonstrate a wide variety in performance on auditory, linguistic, cognitive tasks, as well as speech perception in noise. It is speculated that the causes of this variability are likely to lie beyond hearing aid/cochlear implant technology.

This presentation will first summarize what can be expected of normally developing children with CI(s) with regard to spoken language, bilateral and binaural auditory perception, speech perception and cognitive skills. Subsequently, similar outcome measures will be presented of children with unilateral hearing impairment, who are often assumed to develop language skills as well as their normal hearing peers. Our data show that children with unilateral hearing impairment lag behind on some developmental outcomes, and that these should be addressed at a young age in order to obtain age-adequate performance. Understanding the strengths and weaknesses in different skills of children with different degrees of deafness will allow us to develop or improve targeted interventions.

WIDE-VARIETY OF CLINICAL MANIFESTATIONS OF AUDITORY NEUROPATHY

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Initially, auditory neuropathy was defined as impairments of auditory neural functions, with preserved outer hair cell function. However, today, it is well known that this entity appears to consist number of varieties with different AN types, etiologies, clinical manifestation, sites affected and outcomes of early or late treatment.

OBJECTIVE: To present different types of AN in respect to site affected, clinical manifestation, effect of early treatment on speech development and auditory function 6-10 years after presentation.

MATERIALS and METHODS: The immediate, long term auditory sequelae and the effect of early intervention (medications or/and cochlear implants) were studied in a large number of patients with AN, using, electrophysiology, behavioral measures, otoacoustic emissions, acoustic reflexes, speech development tests and MRIs.

RESULTS: In number of infants, the AN was resolved spontaneously or following supplementary replacement therapy (Transient AN). Others showed permanent or deteriorating AN. Affected sites may involve the ribbon synapses, the auditory nerve, or a lesion of the brain stem ascending auditory nerve itself (Brain stem AN). Each AN type differed in its behavioral and electrophysiological manifestations as well as in outcome of treatment. Six to 12 years later, all patients with transient AN had a audiograms with moderate to normal pure-tone but with significant delay in language acquisition and impaired speech intelligibility, especially in noise. All others types, showed varying degree of neural hearing loss. Cochlear implantation is an excellent choice for rehabilitating children with auditory synaptopathies and they significantly differ from peers with SNHL.

KEYWORDS: Auditory neuropathy, brain-Stem, vitamin B1 deficiency, cochlear Implantation, transient

CORTICAL AUDITORY EVOKED POTENTIALS IN CI AND ABI PATIENTS WITH ANSD

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Patients with auditory neuropathy spectrum disorder can have various audiological outcomes, clinical manifestations, etiologies and site of lesions The outcome of cochlear implantation in these pa-

tients are also various depending on the site of lesion, etiology and the age of implantation.

Cortical potentials, P1N1P2 latencies and MMN were studied in patients with auditory neuropathy spectrum disorder who received a cochlear implant. The results were compared with implanted patients with other etiologies and with normal hearing subjects. The relationship between speech perception scores and cortical potentials will be presented. Individual results and implications for these outcomes will be discussed.

2 patients who received ABI were tested with P1 latency and the individual results of these patients will also be presented

The objective data obtained through cortical potentials indicates that cochlear implantation can be an option to overcome ANSD and to provide a potentially successful method of habilitation

COCHLEAR NERVE DEFICIENCY: ASSESSMENT AND OUTCOMES OF IMPLATATION

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Central Manchester NHS Foundation Trust, UK

OBJECTIVE: To evaluate the presentation, assessment and management outcomes of cochlear nerve deficiency (CND).

MATERIALS and METHODS: Retrospective review of children referred to the Manchester Auditory Implant service with profound hearing loss secondary to CND. Data collected included clinical history, magnetic resonance imaging (MRI) using submillimetric T2 weighted gradient echo or turbo spin echo sequences, computed tomography (CT) using high resolution sequences of the temporal bone, auditory investigations (otoacoustic emmissions, auditory brainstem response testing, behavioural audiometry and electrically evoked auditory brainstem response (EABR)) and outcomes from cochlear implants (CI) or auditory brainstem implants (ABI).

RESULTS: 60 children were assessed; 15 had unilateral or bilateral CI and 10 had an ABI. Evidence of audition following both auditory and electrical stimulation sometimes allowed identification of significant cochlear nerve tissue not visible on MRI. Hearing outcomes from both CI and ABI were limited. A proportion of children received no benefit. Usually the implants provided recognition of environmental sounds and understanding of simple phonetics. Almost all children had poor speech intelligibility and learned to communicate with sign language. Review of the current available literature will be presented for comparison.

CONCLUSION / RECOMMENDATIONS: The assessment process is critical in deciding whether a profoundly deaf child with CND will be suitable for a CI or ABI. EABR testing may help decide whether a CI will be beneficial. Age and cognitive development are the most critical factors in determining ABI benefit. CI and ABI can provide limited benefit although at present the long term benefits are relatively unknown.

KEYWORDS: Auditory neuropathy, prelingual deafness, cochlear implantation, auditory brainstem implantation

PATHOPHYSIOLOGY OF AUDITORY NEUROPATHY AND SYNAPTOPATHY

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Recently, defects of the ribbon synapses between inner hair cells and spiral ganglion neurons have been identified as causing hereditary and acquired hearing disorders. These specialized synapses enable indefatigable sound encoding with utmost temporal precision. Their dysfunctions, which we term auditory synaptopathies, impair audibility of sounds to varying degrees but commonly affect neural encoding of acoustic temporal cues essential for speech comprehension. Clinical features of auditory synaptopathies are similar to those accompanying auditory neuropathy. Genetic auditory synaptopathies include alterations of glutamate loading of synaptic vesicles, synaptic Ca2+ influx or synaptic vesicle turnover. Acquired synaptopathies include noise-induced hearing loss due to excitotoxic synaptic damage as well as age-related hearing loss. I will review cellular mechanisms of synaptopathic and neuropathic hearing impairment and provide considerations of human disease.

Moser, T, Predoehl, F, Starr, A (2013) Review of hair cell synapse defects in sensorineural hearing impairment. Otol Neurotol 34(6): 995-1004.

KEYWORDS: Hair cell, synapse, sound encoding, auditory neuropathy, noise-induced hearing loss

OPA1-RELATED AUDITORY NEUROPATHY: SITE OF LESION AND OUTCOME OF COCHLEAR IMPLANTATION

Rosamaria Santarelli[1], Pietro Scimemi[1], Elona Cama[1], Maria Lucia Valentino[2], Chiara La Morgia[2], Leonardo Caporali[2], Rocco Liguori[2], Valerio Carelli[2]
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OBJECTIVE: To characterize the hearing dysfunction in OPA1-linked disorders and to provide effective rehabilitative options to improve hearing sensitivity and speech perception.

MATERIALS and METHODS: We studied two groups of subjects carrying OPA1 mutations, one including 11 patients with mutations inducing haploinsufficiency (OPA1-H), the other, 10 subjects harboring missense mutations (OPA1-M). Both groups underwent pure tone and speech perception evaluation, and otoacoustic emissions (OAEs) and auditory brainstem response (ABR) recording. Cochlear potentials were obtained from the OPA1-M group through transtympanic electrocochleography and were compared to recordings obtained from 20 normally-hearing controls. Eight OPA1-M patients underwent cochlear implantation. Speech perception measures and electrically-evoked auditory nerve and brainstem responses were obtained after one year of cochlear implant use.

RESULTS: OPA1-H patients had normal hearing. OPA1-M subjects showed impaired speech perception, abnormal ABRs and presence of OAEs consistent with auditory neuropathy. In electrocochleography recordings, cochlear microphonic (CM) and summating potential (SP) were normal, consistently with a preserved outer and inner hair cell function. After CM cancellation, the synchronized compound action potential (CAP) seen in normal ears was replaced by prolonged, low-amplitude negative potentials that decreased in both amplitude and duration during rapid stimulation consistent with their neural generation. After cochlear implantation, speech perception improved and ABRs were restored in response to electrical stimulation. No CAP, however, was elicited in the auditory nerve through the cochlear implant.

INTERPRETATION: Underlying the hearing impairment in OPA1-related disorders is an abnormal synchrony in auditory nerve fiber activity resulting from degeneration affecting the terminal dendrites. Cochlear implantation improves speech perception and synchronous activation of auditory pathways by by-passing the site of lesion.

KEYWORDS: OPA1-related hearing impairment, auditory neuropathy, electrocochleography, cochlear implants, speech perception

THE IMPORTANCE OF IMMITANCEMETRIC EVALUATION IN AUDIOLOGICAL DIAGNOSIS

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Middle ear works as a transducer that converts acoustical energy into mechanical energy. Any pathology in the middle ear can cause some changes in middle ear mechanic system. If apply a known power source to the system, the acoustic and mechanical properties of the outher and middle ear also changes. Tympanometry is a measurement that shows the harmony between the tympanic membrane and middle ear system when changing the air flow in the external ear canal. Volume and mass changes in the middle ear can be demonstrated by using tympanometry. Objective descriptive evaluation is done on tympanograms for active or recurrent pathologies. The acceptance and rejection specifications of middle ear and tympanic membrane can evaluate by using tympanogram. So that even inner ear dilatation can also be distinguished. Middle ear muscle contraction by activation of the acoustic reflex arc is an important measurement parameter. It puts forward the effect of middle ear system upon the hearing when the behavioral tests are not sufficient. Localization of hearing pathology can be found by using site of lesion tests of immitancemetry like reflex decay. In this session, speaker will talk about the measurements and diagnostic criteria of immitancemetric evaluation. The presentation of immitancemetric results of different pathologies gives a new horizon to the listeners and it increases the awareness of audiologists.

COLLABORATION OF AUDIOLOGIST AND SPEECH&LANGUAGE PATHOLOGIST IN CLINICAL SETTING FROM THEORY TO PRACTİCE

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Hearing is primary way in which we acquire the speech sounds of all language; individuals with hearing impairments will have speech and language disorders. Not only sensory-neural hearing loss but conductive hearing loss may affect the speech &language abilities. Also auditory processing disorders (APD) significantly affect speech-language abilities of children especially in articulation and phonology. The collaboration of audiologist and speech language pathologist in clinical setting is very important and they have to study in close cooperation. According scope of practice of SLP's will be discussed regarding hearing loss. Firstly the role of SLP's will be discussed in term of assessment of speech and language abilities in children with hearing loss from conductive to sensory-neural hearing loss addition to APD. The assessment batteries will be shared regarding to pathologies. Not only language test, which include (receptive and expressive language) nor speech sound abilities but also information processing (cognitive-linguistic) assessment will be explained which is very important to develop spoken language. Secondly intervention modalities will be shared. Finally the importance of interdisciplinary approach between audiology and speech language pathology will be emphasized.

RISK FACTORS FOR TINNITUS

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Tinnitus is a symptom rather than a disease. It appears as a symptom of different types of pathologies. Despite intensive and comprehensive investigation, etiology cannot be clarified in almost half of the patients with tinnitus. The diagnosis of those patients is stated as idiopathic tinnitus, as if the symptom of tinnitus is a disease itself. Determinable causes of tinnitus are excessive noise exposure in 25% of the cases, ear problems in about 13-14%, head and neck trauma in 6-8%, and other diseases such as use of ototoxic medicine, temporomandibular joint problems etc. in about 15% of the patients. Some factors cause tinnitus while other factors may predispose patients to having tinnitus and/or aggravate existing tinnitus.

Risk factors for tinnitus can be classified in two groups— definite and indefinite risk factors. Excessive noise exposure, head and neck trauma, some otologic/neurootologic diseases like otosclerosis, vestibular schwannoma, prebiacusis, Meniere's disease, any kind of inflammation in the ear, age, gender, sudden sensorineural hearing loss, ototoxic medicines, thyroid hormone imbalances, temporomandibular joint disorders, and cardiovascular diseases are considered definite risk factors. Alcohol consumption, smoking, anxiety, depression, geographic region, familial inheritance, and poor general health condition are considered as indefinite risk factors. Vestibular schwannoma, neuritis of the auditory nerve and injury to the cochlear nerve due to external or surgical trauma are associated with the highest risk of tinnitus.

To explain simply, some risk factors for tinnitus seen to be exaggerated a little in some studies. Gustatory impairment, olfactory impairment, high body-mass index as well as low body-mass index, low height, rural residence, low education, etc. may not be easy to explain as risk factors for tinnitus.

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AIR CONDUCTED CERVICAL AND OCULAR VESTIBULAR EVOKED MYOGENIC POTENTIALS IN PEUDOTUMOR CEREBRI PATIENTS

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BACKGROUND: Pseudotumor cerebri is a disorder of unknown etiology that results in raised intracranial pressure (ICP) and characterized by attendant signs and symptoms of increased ICP in an alert and oriented patient but without localizing neurologic findings. Vestibular evoked myogenic potentials (VEMPs) are short latency reflex responses produced by stimulation of the vestibular apparatus.

OBJECTIVE: The purpose of this study was to determine whether group of pseudotumor cerebri patients have abnormal changes in VEMPs (cervical and ocular) and to analyze the results and compare them with matched group of normal subjects.

MATERIALS and METHODS: Ocular and cervical VEMPs were performed to the entire study groups. The responses were obtained from thirteen pseudotumor cerebri patients and compared to fifteen age matched normal subjects. All participants were subjected to audiological assessments that include pure tone audiometry, tympanometry and acoustic reflexes.

RESULTS: Ocular and cervical VEMPs amplitudes were reduced in response in pseudotumor cerebri patients than normal but still of non-statistical significant difference $p>0.05$.

DISCUSSION AND CONCLUSION: The results of this study suggest that patients with pseudotumor cerebri do not have statistically significant changes in comparison with the normal control as regard ocular and cervical VEMPs testing. Hence, asserting a query whether there is affection of VEMPs in pseudotumor cerebri patients.

KEYWORDS: Vestibular evoked myogenic potentials, pseudotumor cerebri, idiopathic intracranial hypertension, oVEMPs, cVEMPs, dizziness

THE ROLE OF POSTUROGRAPHY IN NEUROLOGICAL DISEASES

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OBJECTIVE: Dynamic posturography assesses the integration of visual, vestibular and somatosensory systems. The aim of this study is to compare scores of sensory organization test (SOT) in computerized dynamic posturography (CDP) between patients with multiple sclerosis (MS), Parkinson's disease and healthy individuals and to emphasize the role of posturography in neurologic diseases.

MATERIALS and METHODS: 10 patients with MS, 10 patients with Parkinson's disease and 10 individuals without any neurologic problems were included in this study and CDP-SOT were performed. The mean age values of each group were respectively; 47.0±3.83 in the group with MS, 71.20±10.31 in the group of Parkinson's disease and 74.0±9.59 in the healthy group. This study comprises of a total number of 15 women and 15 men. It was endeavoured to achieve an equal distribution regarding the gender in each group.

RESULTS: There were significant differences in terms of SOT condition 2, SOT condition 3, somatosensory, visual, preference scores between the groups ($p<0.05$). The mean values of these parameters for MS group were lower than Parkinson's disease and healthy groups. It could have not been found any significant differences in terms of composite equilibrium scores and vestibular scores between the groups ($p>0.05$).

CONCLUSION: Although somatosensory and visual alignments decreases in both research groups, patients with MS are less successful than Parkinson's patients in terms of usage of their somatosensory and visual references for balance control. However visual inputs are not reliable, MS patients use more preference references for their equilibrium.

KEYWORDS: Multiple sclerosis, Parkinson, balance

HEAD SHAKE-SENSORY ORGANIZATION TEST EFFECTIVENESS ON PATIENTS WITH DIZZINESS

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OBJECTIVE: Traditional methods like computerized dynamic posturography (CDP) or Videonystagmography (VNG) are not useful for detecting vestibular problems with highly compensated. Because of their limitations, Head Shake-Sensory Organization Test (HS-SOT) has been developed with addition of active head movements to standard SOT. This study was aimed to determine HS-SOT effectiveness in dizzy patients with SOT scores within normal limits and compare the results of healthy subjects.

MATERIALS and METHODS: This study included 12 patients who were referred to Hacettepe University, Department of Audiology with dizziness complaints. They were divided into 2 groups: patients with BPPV (age range, 21-47 years; Mean: 34.6±9.4 years; 4 Female, 2 Male) and with Non-vertiginous dizziness (NVD) (age range, 21-46 years; Mean: 35.8±10.2 years; 6 Female). Control subjects included 6 healthy individuals (age range, 27-40 years; Mean: 31.8±4.8 years; 4 female, 2 male). After Caloric test, VNG and SOT were performed, subjects were evaluated with HS-SOT in yaw (20° amplitude, 85°/s peak head velocity), pitch (20° amplitude, 60°/s peak head velocity) and roll (20° amplitude, 40°/s peak head velocity) axes.

RESULTS: When healthy group and the groups which include patients with BPPV and NVD were compared, a significant difference ($p<0.05$) has been found on HS-SOT 5 scores in pitch axis ($p<0.05$). However, there were no statistically significant difference between patients with BPPV and NVD on any test scores ($p>0.05$).

CONCLUSION: Our findings suggest that head movements constitute an important parameter for the evaluation of CDP and head shake modification can be used efficiently on individuals suffering from dizziness.

KEYWORDS: Head shake, posturography, vestibular, BPPV, dizziness

COMPARATIVE STUDY OF DIZZINESS HANDICAP INVENTORY AND SENSORY ORGANIZATION TEST

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OBJECTIVE: When the related literature is studied, it is observed that the dizziness has a high incidence rate and is one of most common complaints that cause a person to consult a physician within all age groups. In order to assess the effects of dizziness on the life standard and physical condition of a person, generally Dizziness Handicap Inventory (DHI) and posturography (CDP) tests are used. However, there are still some uncertainties regarding how and how frequent inadequacies occur in the daily lives of individuals suffering from dizziness. The aim of this study is to compare DHI and VNG tests with Sensory Organization Test (SOT) which a subtest of CDP within the individuals suffering from dizziness and analyse the relation between these tests.

MATERIALS and METHODS: In this study, 18 individuals who had applied to Audiology Unit of Hacettepe University (aged between 21 and 47 yr; Mean: 32.2±9; 12F and 6M) with complaints of dizziness, are included.

RESULTS: When the results of the tests applied to the individuals included to the study, no abnormalities were observed and normal figures were obtained regarding SOT mean values (70-86, M= 79.9±4.7). And no statistically significant correlation between the DHI (20-70, M=38.6±14.9) and SOT scores was observed.

CONCLUSION: According to the results of the study, in relation to assessment of dizziness, DHI, SOT and VNG tests are observed to be insufficient and alternative methods should seriously be considered regarding the individuals that continue their dizziness complaints even if normal values are obtained in these tests.

KEYWORDS: Dizziness, DHI, Posturography

ASSESSING THE EFFECTIVENESS OF VESTIBULAR REHABILITATION BY MEANS OF COMPUTERIZED DYNAMIC POSTUROGRAPHY

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Postural control is the ability to maintain equilibrium and orientation in a gravitational environment. Patients with vestibular dysfunction have some troubles with postural stability. The present study aimed to assess the benefit of vestibular rehabilitation with computerized dynamic posturography. Therefore, 15 subjects (10 female, 5 male), between 18 to 60 years (mean 43.6±11.6), diagnosed with peripheral vestibular disorders were included in the study. Videonystagmography was performed to exclude the central vestibular pathologies. Computerized dynamic posturography was performed to assess postural stability. Vestibular rehabilitation programs included exercises tailored to special needs of each patient. After vestibular rehabilitation, patients were re-examined by means of the same tests. Posturographic data were analyzed and compared to previous findings. Before vestibular rehabilitation, the average of composite scores was 58.9 and standard deviation was 9.15. After vestibular rehabilitation the average of composite scores was 74.3 and standard deviation was 7.16.This result is found to be statistically significant. Final results suggest that effectiveness of vestibular rehabilitation can be assessed by computerized dynamic posturography.

KEYWORDS: Vestibular rehabilitation, computerized dynamic posturography

THE EFFECTS OF CAFFEINE ON THE HEAD SHAKE-SENSORY ORGANIZATION TEST

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OBJECTIVE: Although there is a common belief on the effects of caffeine on the vestibular system, previous researches conducted on this area are limited. One of the tests which are used to evaluate the balance system is the Sensory Organization Test (SOT), protocol of computerized dynamic posturography. The aim of this study, is to reveal the effects of caffeine on the balance ability of healthy individ-

uals using SOT and the head movements modification of SOT Head Shake-Sensory Organization Test (HS-SOT).

MATERIALS and METHODS: Six healthy volunteers aged between 19 and 26 years (Mean: 22,83 yrs; SD: 1,6 yrs) participated the study in Hacettepe University Audiology Department. Participants weren't allowed to drink any caffeinated beverages on the day of the test and SOT and HS-SOT in yaw (20° amplitude, 85°/s peak head velocity), pitch (20° amplitude, 60°/s peak head velocity) and roll (20° amplitude, 40°/s peak head velocity) axes were performed. In a period of 24 hours, approximately 300 mg of caffeine was given to the individuals and 45 min after the participant consuming the caffeinated beverage, same tests were applied to re-evaluate.

RESULTS: There was a statistically significant difference between the caffeine and nocaffeine sessions on SOT composite scores.($p<.05$). Nevertheless, on the other test scores, no statistically significant differences were found. ($p>.05$).

CONCLUSION: In conclusion, the result of this study indicate that caffeine can improve the balance ability in a short period. In the future studies, the number of participants may be increased and age groups may be differentiated as well.

KEYWORDS: Posturography, caffeine, head shake

IS VIRTUAL REALITY BETTER THAN PLATFORM-BASED VESTIBULAR REHABILITATION METHODS?

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OBJECTIVE: To evaluate by comparison quality of life changes and physical benefit induced by vestibular rehabilitation (VR) customized programs based on either pressure-platform devices (Neurocom system) or virtual reality in patients with acute vestibular neuritis.

SUBJECTS: Two matched groups of 8 patients each diagnosed with vestibular neuritis (VN) were included in this 20 month prospective study. The 16 consecutive patients presented at the Institute of Phono-Audiology and ENT Functional Surgery were diagnosed with vestibular neuritis base on history, bed-side vestibular evaluation with infrared binocular camera, posturography and pure tone audiometry.

MATERIALS and METHODS: All patients from both groups followed 24mg twice per day Betahistine treatment associated with VR customized programs: daily at home exercises derived from Cawthorne's, Cooksey's and Herdman's protocols associated with weekly VR platform-based session in group 1 and virtual reality session in group 2. VR programs lasted until patients were clear of intial symptoms and were able to resume their daily activities.

MAIN OUTCOME MEASURES: Quality of life (QoL) was assessed before and after VR, using qualitative criteria - Dizziness Handicap Inventory (DHI), Activities-specific Balance Confidence scale (ABC) and Visual Analog Scale (VAS) for vestibular symptoms. Physical performance was assessed before and after VR by means of quantitative test: Sensory Organization Test (SOT), Dynamic Gait Index (DGI), Berg Balance Scale (BBS), Short Physical Performance Battery (SPPB) and Performance-Oriented Mobility Assessment (POMA).

RESULTS: When included in the study, both groups were similar regarding age, sex distribution, time of presentation, presence of spontaneous nystagmus, results in SOT, Romberg, stepping test and DGI and questionnaires of QoL (Fisher's exact test, independent-samples Mann Whitney U test, $p>0.05$).

Even though it was a 20 days difference in length of VR programs in favor of virtual reality-based VR programs, this difference was not statistically significant.

Virtual reality customized programs significantly improved all parameters (related-samples Wilcoxon signed rank test, $p<0.05$). SOT results revealed better global balance improvement in group 2 (independent-samples Mann Whitney U test, $p=0.041$). Greater improvement scores were obtained in group 2 of patients also for ABC-scale and DHI, but without statistical significant differences between the groups (independent-samples Mann Whitney U test, $p>0.05$).

For VAS, symptomatology diminished more in group 1, without statistical significant differences between the groups (independent-samples Mann Whitney U test, $p>0.05$).

From physical performance tests point of view (BBS, SPPB, POMA, DGI), improvement was similar in both groups of patients.

CONCLUSION: VR improves quality of life in vestibular neuritis patients. It increases self-confidence and reduces intensity of symptoms during usual activities. Virtual reality offered better improvement than platform-based VR customized programs both in physical activities as well as in QoL.

KEYWORDS: Vestibular neuritis, customized vestibular rehabilitation program, virtual reality

UK GUIDELINES FOR THE MANAGEMENT OF TINNITUS IN CHILDREN

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Recent surveys showed that many professionals in the UK were not happy with their level of knowledge or management skills on paediatric tinnitus. While the underlying principles of managing tinnitus in adult patients can be applied to the management of tinnitus in children and young people, there are important differences in the aetiology, presentation and management of tinnitus in a child.A multidisciplinary Paediatric Tinnitus Working Party was formed to develop guidelines for the management of tinnitus in children.

These guidelines offer a pragmatic approach to the management of tinnitus in children. They are based on the current evidence base where it is available, and from the clinical experience and practice of the working party members.

Having a flexible approach to the management strategies used with children is essential. All approaches must be child-focused and it is important to engage the child directly in any strategies used. Even for children distressed by their tinnitus, a good, well structured, explanation of what tinnitus is has the largest impact on reducing their distress and all other strategies build on this. Helpful management approaches can include discussion of age appropriate information about tinnitus with the child, reassurance and advice on practical strategies for alleviating tinnitus distress. It can also include support for managing tinnitus in different situations eg the classroom. The most useful management strategies are based on the information elicited after providing the child with opportunities to talk about the noises that they hear.

Identifying effective coping strategies can help a child to develop a sense of control. Strategies for relaxation, sleep and noise control can also be helpful. Where tinnitus distress and impact require intervention, the psychology developed Child Friendly Model of Tinnitus used in the guidelines has been found to be a helpful way to gather information and to explain tinnitus for child and parent. The model addresses three aspect of tinnitus: auditory, attentional, and emotional. Narrative therapy techniques are also discussed in the guidelines.

The guidance provide a toolkit of different management approaches. The strategies must be tailored to the needs of the children and their families and be appropriate to the age and level of cognitive and linguistic understanding of the child. The guidance explores strategies for use within home and school including functional listening and mindfulness techniques. They also include a sample guide and workbook to help a child with tinnitus cope more effectively within the school setting.

KEYWORDS: Tinnitus service children guidelines

THE RELATIONSHIP BETWEEN DIX – HALLPIKE OR ROLL TEST AND HEAD IMPULSE TEST

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INTRODUCTION: Dix-Hallpike and roll test are two of the positional tests that provide information about posterior, anterior and lateral semicircular canals, especially when applied to patients with suspected benign paroxysmal positional vertigo (BPPV).

Video head impulse test (vHIT) is a useful test gives information about vertical and horizontal canals, vestibular nucleus and vestibular nerve in both ears. This study was conducted to assess the relationship between Dix – Hallpike/Roll Test and vHIT.

MATERIALS and METHODS: 76 patients (47 female, 29 male) who was referred with a diagnosis of BPPV to Istanbul University Cerrahpasa Medical Faculty Hospital to Audiology Department and whose age between 21 and 57 has evaluated. All patients were evaluated with Dix-Hallpike/Roll Test and vHIT tests and results were compared.

RESULTS: Acording to Dix-Hallpike/Roll test results, it was found posterior canal BPPV in 55, lateral canal 18 patients and anterior canal BPPV in 6 patients. Results will be discussed.

KEYWORDS: Dix-Hallpike, video head impulse test, vestibular, BPPV

EFFECTS OF EXTRA-COCHLEAR DIRECT CURRENT STIMULATION ON HEARING IN CONTROL AND TINNITUS SUBJECTS

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OBJECTIVE: To investigate the effects of extra-cochlear electrical stimulation on hearing in normal-hearing and tinnitus subjects.

MATERIALS and METHODS: Group I - 49 tinnitus patients (n - 71 tinnitus ears). Group II (control) - 21 healthy subjects without tinnitus (n – 41 ears).

Electrical stimulation was performed with the use of hydrotransmissive method. The active electrode was immersed inside external ear canal filled with 0.9% saline solution. The passive electrode was placed on the forehead. Direct current (train of squared pulses) was applied via the active electrode. Different pulse train frequencies were used: 0.25, 1, 2, 3, 4, 5, 6, 7, 8 kHz. The protocol was first done for positive, then negative current polarisation. For each frequency of stimulation and current polarity, the current level was slowly raised until the subjects report an auditory perception.

RESULTS: Auditory perceptions were produced at lower levels for negative currents compared to positive currents. Larger levels of currents were required to produce auditory perception when the frequency of pulse train was increased. A sound perception was present for both positive and negative stimulation in group I – in 41ears (57.75%), in group II - in 36 ears (87.80%). In group I it was mainly present for stimulating frequencies 0.25-2kHz, in group II – in the whole stimulating range (0.25-8kHz). In group I larger current intensities were needed to evoke sound perception.

CONCLUSION: Positive and negative non-invasive electrical stimulation of the ear can produce an auditory perception indicating excitation of the auditory system.

KEYWORDS: Electrical stimulation, direct current, tinnitus

SELF-EFFICACY IN TINNITUS PATIENTS

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Self-efficacy can be defined as the trust that individuals carry in their abilities to perform certain task or their ability to organize and carry out activities in stressful situations, being determining in behavior modification.

We evaluated the self-efficacy in 58 patients with tinnitus complaints. By using the t-test for equality of averages, for general self-efficacy, self-efficacy of initiation and persistence, and self-efficacy for adversity, it has been attained that self-efficacy perceived by men is higher than amongst women. For social self-efficacy there cannot be found any statistically significant differences.

Through Pearson's Correlation it has been verified that there are correlations between the values obtained in the range of general self-efficacy and its subscales and age, years of schooling, time with the complaint of tinnitus, and QoL measured by THI, not existing correlations with the values of the VAS for the intensity of tinnitus.

The obtained results confirm the existence of various relations between perceived self-efficacy and QoL values of individuals with tinnitus. Being a variable that has a cognitive component combined with emotional aspects, it may be helpful to find strategies to improve self-efficacy.

The use of a physical instrument like a small manual, which the patient can be able to access whenever he has doubts or feels more upset about the tinnitus, and that may give him information about their problem, as well as strategies to improve how to deal with it more efficiently, can be an asset for these patients.

KEYWORDS: Quality of Life (QoL), self-efficacy, tinnitus

RESULTS OF TENS APPLICATION IN THE CERVICAL REGION IN PATIENTS WITH SUBJECTIVE TINNITUS (PRELIMINARY STUDY)

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AIM: The aim of this study was to evaluate the results of TENS application in the cervical region in patients with subjective tinnitus.

MATERIALS and METHODS: Six patients with subjective tinnitus were included in this study. The pure tone audiometry, speech audiometry, impedance audiometry, the measurement of tinnitus pitch and loudness matching, minimal masking levels and residual inhibition were carried out in all patients. Tinnitus participants were also completed the Visual Analogue Scale (VAS), Tinnitus Handicap Inventory (THI), Beck Depression Inventory (BDI), The World Health Organization Quality of Life (WHOQOL). TENS treatment were applied to cervical region 15 minutes per day for ten days. The initial measures and assessments were repeated after treatment.

RESULTS: The mean pretreatment THI emotional, mean THI total and mean VAS tinnitus scores were 22.66±6.40, 68.66±18.3, 6.20±1.37, respectively. The mean postreatment THI emotional, mean THI total and mean VAS tinnitus scores were 14.33±8.43, 50.66±22.36, 4.76±1.69, respectively. The mean THI emotional, THI total scores and VAS tinnitus scores showed significant difference between pre and post treatment ($p<0.05$).

CONCLUSION: THI and VAS tinnitus scores were significantly improved in patients with subjective tinnitus after TENS treatment.

KEYWORDS: Tinnitus, THI, TENS, VAS tinnitus

THE ASSOCIATION BETWEEN CHILDHOOD HEARING DISORDERS AND TINNITUS IN ADULTHOOD: RESULTS FROM A COHORT STUDY (HUNT)

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OBJECTIVE: To examine the association between different types of hearing loss in childhood and tinnitus in adulthood.

DESIGN, SETTING AND PARTICIPANTS: Population-based cohort study of 32,786 adults (aged 20-56 years) who underwent pure-tone audiometry and completed a hearing health questionnaire in the Nord-Trøndelag Hearing Loss Study. As children, the same persons underwent screening audiometry in a primary school hearing investigation, including Ear, Nose & Throat examinations when indicated.

INTERVENTIONS: Pure-tone audiometry, questionnaires and Ear, Nose & Throat examinations.

MAIN OUTCOMES AND MEASURES: Self-reported tinnitus (yes/no) in adulthood measured by questionnaires.

RESULTS: Adults who had hearing loss at the school investigation (n=3026) reported more tinnitus than did adults with normal childhood hearing (n=29,404) (odds ratio [OR] = 1.4, 95% confidence interval [CI]: 1.3—1.6). Childhood hearing disorders associated with tinnitus in adulthood included: sensorineural hearing loss, chronic suppurative otitis media, and hearing loss associated with a history of recurrent acute otitis media (OR = 2.4, CI: 1.9—3.0; OR = 2.4, CI: 1.5—3.9; OR = 1.6, CI: 1.3—2.0, respectively). These estimates were adjusted for the children's age, sex, and noise exposure in adulthood. After further analyses that included adjustment for adult hearing threshold, none of these childhood hearing disorders remained positively associated with tinnitus.

CONCLUSIONS AND RELEVANCE: Childhood hearing disorders associated with tinnitus in adulthood include sensorineural hearing loss, chronic suppurative otitis media, and hearing loss associated with a history of recurrent acute otitis media. It appears these significant associations are mediated or transmitted through adult hearing loss.

KEYWORDS: Childhood hearing loss, risk factors, tinnitus, otitis media

CONSIDERING ACOUSTIC/CONDUCTIVE BALANCE AND THE NASAL RESONANCE IN OCCLUSION MANAGEMENT

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Successful treatment for hearing loss with open fittings has become the norm as this alleviates many traditional complaints associated with occlusion. But many processing features (such as directionality) have limited benefits because low frequency sound is not processed by the system (it travels directly to the TM bypassing the hearing device). A more closed system could improve performance in noisy situations, but is much harder to accept for sounds generated internally (such as the listener's own voice). What is considered occlusion (an increase in low frequency levels of the listener's voice when the ear canal is obstructed) is not always the cause of complaints. Rather, the two signal paths (acoustic and conductive) are no longer balanced, and this makes the listener's own voice either boomy or artificial. A simple clinical method to balance the level of acoustic and conducted signals will be presented that solve many voice issues, allowing the use of smaller vents or more occluding fittings, increasing the potential benefit from advanced signal processing available in modern digital hearing devices. This method also matches the contribution of the nasal resonance that is often missing in fittings and leading to nasality of the listener's voice. This method can be used in any fitting system that offers frequency shaping control for loud sounds, as this is the level of the listener's voice at the input to the hearing device. Case studies will be presented demonstrating the ability of this technique to decrease own voice complaints.

KEYWORDS: Occlusion, programming, compression, output, acoustic / conductive

DEVELOPMENT OF A QUESTIONNAIRE FOR THE ASSESSMENT OF SOUND PREFERENCES AND HEARING HABITS OF PEOPLE WITH DIFFERENT DEGREES OF HEARING IMPAIRMENT

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For the usage of hearing aids and listening devices it is difficult to predict individual sound preferences only on the basis of audiological predictors, such as pure tone audiograms or speech reception thresholds. Different factors like personality, habits, cognitive performance and individual needs were addressed to individualize and enhance the acceptance of hearing aids and the joy of use of listening devices.

In the present report we assume that the attitudes towards sound and hearing preferences are formed by a sound personality trait, which is relatively stable over time, but still influenced by the degree of hearing loss and the usage of hearing aids.

For the present study we developed a questionnaire with 46 items, based on expert interviews and focus group discussions with impaired (aided and unaided hearing impaired persons), as well as unimpaired persons. We addressed the topics sound preferences, sound disturbance/artifacts, noise sensitivity, needs for clear speech and 'atmo' sounds, and the need for cognitive closure in noisy situations. 681 from 873 persons sent back the questionnaire. The mean age was 70 years with a range from 20 to 91 years; 46.3% were female. 36.9% of the sample was not hearing impaired (PTA < 26 dB, WHO Better Ear). 49.7% were using hearing aids (PTA: 46.9 dB HL).

We present first results, focusing on differences between the different groups (impairment, hearing aid usage) and exploratory factor analyses towards a very first step investigating the existence of a "sound personality".

KEYWORDS: Sound preference, personality, questionnaire, listening devices, hearing aids

EVALUATING THE EFFECTIVENESS OF BINAURAL HEARING AID PATIENTS WITH ASYMMETRIC HEARING LOSS ON SPEECH INTELLIGIBILITY TEST RESULTS AND LATERALIZATION OF SOUND

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Binaural hearing aid is more physiological compared with monaural and provides patient benefits such as the ability to locate the sound source in the horizontal and vertical planes, increases the signal / noise ratio, sense of balance, especially at night and improved features intelligibility of speech. Violation of auditory function leads to disruption of binaural hearing. Adequate and timely hearing aid allows to save this function. In asymmetric hearing loss indications for binaural hearing aid was considered hearing loss, in which the difference of average hearing thresholds did not exceed 20 dB. This approach unnecessarily narrowing the indications for binaural hearing aid appointment that led to monaural use of hearing aid and prevents sensory deprivation the other ear. The aim of our study was to explore the possibilities of binaural hearing aid patients with asymmetrical hearing impaired. We observed 48 patients with chronic sensorineural hearing loss and mixed medium to severe and ear difference between 25 and 35 dB. The age of patients ranged from 23 to 72 years, 21 women and 27 men. All patients, regardless of previous experience, selection was carried binaural hearing aids. To assess the effectiveness of tests used lateralization of sound and speech intelligibility in words, phrases and sentences. In most patients (36 individuals, 75%) for the test results lateralization of sound was achieved binaural balance volume. In 12 patients (25%) use the term hearing aid was more than 10 years were different perceptions of sounds and require a long process of adaptation.

Continue...

KEYWORDS: Binaural hearind, hearing deprivation, asymmetric hearing loss

LISTENING EFFORT OF HEARING AID USERS IN DAILY LIFE

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To evaluate the efficiency of a hearing aid provision it is important to evaluate the benefit in daily life that is given by improving subjective listening effort (LE). Since only a few self-report tools are available to derive listening effort in daily life, a new questionnaire was developed that covers a broad range of acoustical situations in which hearing-impaired persons suffer in terms of listening effort in daily life.

With the help of audiology experts and hearing-impaired listeners 29 different situations were identified. Apart from rating the subjective listening effort in the respective situation also the importance and frequency of occurrence in daily life have to be rated in order to estimate the relevance of each situation. Situations with a high relevance should have a high impact on the efficiency of the hearing aid provision.

The LE-Questionnaire was used in a multi-center study in different language areas: Danish, American English and German to evaluate listening effort and situation relevance across these language areas. The goal was to develop an optimized version of the LE-Questionnaire that incorporates the most relevant situations to ensure that this tool evaluates the efficiency in daily life. Only situations with no cultural differences across the three language areas are included in the new version which consists of 17 situations in its final version. As a further result of the multi-center study we included a new rating scale that facilitates rating subjective listening effort for the subjects and has advantages with regard to statistical data analysis.

KEYWORDS: Listening effort, daily life, hearing aid, self-report questionnaire

YES WE SCAN: THE TECHNOLOGY BEHIND A 3D SCANNING SYSTEM FOR THE EAR

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For several decades 3D scanning has been utilized in various industries, including manufacturing, architecture and medical applications. In the hearing aid industry this type of technology has long been used for scanning of custom earmold impressions to streamline the sculpting and building process for hearing aid shells and earmolds. It has been a goal for manufacturing – and a dream for most audiologists – to be able to scan the ear directly and avoid the earmold impression process completely. The ear and its anatomy present several unique challenges for 3D scanning to take place. Due to the S-shaped curvature of the ear canal, both the camera and the laser light source necessary for data collection need to be physically placed down into the ear canal close to the surface being scanned. With an average diameter of only about 5-6 mm at the isthmus and two bends to navigate, it is easy to see the dimensional challenge presented by the ear.

This presentation will outline the technology required to capture reliable and repeatable images of the ear canal and outer ear for creation of custom hearing devices while maintaining patient safety and comfort. Challenges and barriers to the implementation of this technology, as well as engineering feats to overcome these barriers will be addressed. Patient case studies highlighting the benefits of scanning technology will be presented.

KEYWORDS: 3D Scanning, technology, ear impressions

BINAURAL MICROPHONE APPLICATIONS IN WIRELESS CROS DEVICES: IS NARROW DIRECTIONALITY BENEFICIAL IN HIGH NOISE ENVIRONMENTS?

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Contralateral Routing of Signals (CROS) has been available for single sided deafness for many years. It is a simple way to give a patient an awareness of sounds from the deaf ear, but has the limitation of placing the burden on an ear already responsible for listening to half the world. Systems are cosmetically and functionally superior to early version since wireless CROS is now possible. But along with Wireless CROS, advanced directionality is now possible, to improve SNR in noisy environments, which are very difficult for these patients. Performance in a cohort of 10 CROS and 10 BICROS subjects using a narrow 4 microphone directional system in loud noise will be presented, demonstrating the benefits of such a system for BICROS patients, but no advantage was found for CROS patients.

KEYWORDS: CROS, BICROS, wireless, binaural directionality, performance in noise

INTRACOCHLEAR ACOUSTIC STIMULATOR IMPLANT (ICAS-IMPLANT)

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Active middle-ear implants were introduced into ear surgery more than 20 years ago. In selected patients they may promise higher sound fidelity, less feedback problems and improved robustness, as compared with conventional hearing aids. Today, they are used for various implications including selected cases of sensorineural hearing loss, of combined hearing loss, and in rare cases of conductive hearing loss.

Within a 3-years (2012-2015) multidisciplinary project, supported by the german federal ministry of education and research, a new acoustical implant system has been developed.

The aim of that study was to develop a system that provides a high sound quality and allows a short and minimal invasive surgical procedure.

Our novel concept of a middle ear implant is based on optical transmission of the acoustic signal and direct mechanical stimulation of the cochlea. The optical transmission path comprises an infrared transmitter in the auditory canal in front of the tympanic membrane and a photo-diode array sensor behind the membrane. The implantable part comprises the optical sensor, an active actuator driver circuitry and a piezoelectric actuator, all connected and integrated on a flexible polymer cable. The longitudinal expansion transducer can be implanted in the inner ear and allows therefore a reliable hydrodynamic coupling to the inner ear fluid.

The external, retroauricular case includes the energy supply, a microphone and a signal processor. The individual programming of the signal processor can be carried out by a "cloud-based" software platform.

The avoidance of a mastoidectomy minimizes the operating time and risk. The whole system has been tested in temporal bones with different acoustical input signals.

KEYWORDS: Middle ear implant, optical transmission

ACCEPTIBILITY AND EFFECT OF THE NUCLEUS FITTING SOFTWARE (NFS) COMPARING WITH THE CUSTOM SOUND SYSTEM

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Cochlear implantation is a viable treatment for individuals who present with moderately severe to profound hearing loss. Significant benefits are achievable with this treatment option, but to realize these benefits the device must be appropriately programmed. The study detailed here investigated the acceptability and the effect of the Nucleus Fitting Software, comparing it with the existing Custom Sound system. Specifically speech perception and hearing quality for the cochlear implant recipients was investigated.

Twenty cochlear implant users participated in this study. Their auditory and speech abilities were evaluated using the following: behavioural audiometry and the Turkish version of the monosyllabic word recognition test (Dokuz Eylul University Monosyllabic Word Recognition Test).

The preliminary results suggest that there are no significant differences between fitting recipients with the two different programming systems. The NFS provides an objective and rapid method of programming a cochlear implant recipient, which may be useful in the initial programming of implant users.

KEYWORDS: Cochlear implant, cochlear implant programming, fitting software

HEARING PRESERVATION COCHLEAR IMPLANTATION WITH MID SCALA ADAVANCE BONICS COCHLEAR IMPLANT BY USING ROUND WINDOW APPROACH

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OBJECTIVE: Hearing preservation cochlear implantation has already became a routine procedure for thousands of candidates. The surgical procedure requires special atraumatic approach aiming preservation of inner ear structures, but it also requires special electrode design to not to harm intralabirynthine compartments. Pre-curved electrode gives the possibility to control the trajectory of insertion.

MATERIALS and METHODS: 20 adult patients with substantial residual hearing were implanted with Mid-Scala electrode Advance Bionics cochlear implant by 6 steps Skarzyński using round window approach. Hearing preservation rate was assessed by tonal audiometry and a battery of speech audiometry tests pre-operatively and in 1 and 6 months after surgery.

RESULTS: Preservation of residual hearing within 10dB comparing to pre-operative thresholds in 1 month after surgery was attained in 90% of cases, and in 85% of cases.

CONCLUSION: Mid – scala Advance Bionics cochlear implant is a confirmed tool for hearing preservation surgery.

KEYWORDS: Cochlear implantation, hearing preservation, perimodiolar array

"GLIMPSING" IN CI-LISTENERSI FLUCTUATING NOISE

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OBJECTIVE: In the literature, there is no evidence for the general ability of glimpsing in CI-listeners, which is better speech comprehension by the use of temporal gaps in noise. However, preliminary data in a pilot study indicated, that glimpsing is present in CI-listeners and possibly dependent on the preprocessing algorithms. Hence, glimpsing in CI listeners was investigated systematically in the present study.

MATERIALS and METHODS: Twenty postlingually deafened CI-listeners (CI24RE und CI512) with a CI-experience of at least one year and bilateral residual hearing of less than 40 dB HL were investigated. The Göttingen sentence test was performed in quiet and with an SNR of +5dB, both for CCITT-noise and for a speech modulated noise (Fastl-noise). All tests were conducted with two different preprocessing

strategies: ASC (automatic sensitivity control) and ASC+ADRO (adaptive dynamic range optimization).

RESULTS: The mean sentence recognition rate improved significantly in FastI-noise compared to the CCITT-noise by 14.1 percentage points (PP) with ASC preprocessing and by 11.4 PP with ASC+ADRO preprocessing. The inclusion of ADRO led to an improvement of 10.3 PP for the CCITT-noise and 7.6 PP in the FastI-noise.

CONCLUSION: The majority of CI-listeners benefited from gaps in fluctuating FastI-noise, largely independent of the use of ADRO. A general improvement of sentence recognition was found for the inclusion of ADRO to the signal processing. Apparently, there are additional factors, why glimpsing was not observed in other studies with CI-listeners.

KEYWORDS: Glimpsing, fluctuating noise, masking release, FastI-noise, ADRO, CCITT

DEEP INSERTION– ROUND WINDOW APPROACH FOR HEARING PRESERVATION SURGERY BY USING SOFT ELECTRODES: FLEX EAS, FLEX SOFT, FLEX M

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OBJECTIVE: Preservation of substantial or residual preoperative hearing is becoming a challenge and necessity in perspective of treatment of sensory-neural hearing losses. Keeping in mind, that future technologies will bring procedures which might have the potential to restore function of organ of Corti it is essential to preserve cochlea inner structure. Technical parameters of new types of electrodes – soft ones – make it possible to minimize potential intracochlear insertion trauma.

MATERIALS and METHODS: Atraumaticity of insertion of Flex soft, EAS, and M electrodes in groups of, respectively: 91, 47 and 62 was assessed. In analyzed insertions round window approach cochlear implantation surgical technique was used for treatment of partial deafness. In all implanted patients steroids were administered peri-operatively and up to 14th day postop. Atraumaticity was evaluated by means of assessment of pre- and postoperative hearing measurement in tonal audiometry and position of electrode inside cochlea by means of CT computed tomography.

RESULTS: According to categorical scale of the new classification of hearing preservation groups implanted with Flex soft, EAS and M resulted with partial preservation of hearing at activation. Similar calculations were performed in further follow up intervals. In radiological evaluation there was no dislocation of electrode from scala tympani into any other compartment of labirynth. Angular depth of insertion was assessed.

CONCLUSION: It was stated that these soft electrodes used in surgical procedure of round window approach entirely fulfill requirements of "soft-surgery" and give chances for complete hearing preservation even when performing deep insertions covering distribution of all frequencies.

KEYWORDS: Hearing preservation, residual hearing, atraumatic insertion

INTRAOPERATIF RESULTS IN AUDITORY NEUROPATHY PATIENTS WITH COCHLEAR IMPLANTS

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INTRODUCTION: Auditory neuropathy is synchronization disorders of auditory function. Auditory synchronization disorders caused by auditory nerve and by synaptic area of auditory nerve with inner hair cell. The functional impairment occurs during the transformation of energy from inner ear or after the conversion electrical energy. Cochlear implant is an amplificator that direct stimulate auditory nevre. How is the electrphysiological response in auditory neuropathy patiens? The purpose of this study was to investigate intraoperative the electrophysiological response in auditory neuropathy patients.

MATERIALS and METHODS In this study, 9 patients with auditory neuropathy and 10 patients with non-auditory neuropathy were included. İntraoperative measurements were performed each patients after cohlear implantation. İmpedance and Neural Response Threshold (NRT) were evaluated in the intraoperative measurements. Obtained values were copared statistically in patients with and without neuropathy.

RESULTS: Obtained electrophysiological responses provides important information to clinicians during rehabilitation

KEYWORDS: Auditory neuropathy, cochlear implants

VARIABLE STIMULATION RATES FOR COCHLEAR IMPLANTS

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State-of-the-art cochlear implants perform a frame-based signal processing on the incoming audio signal with a fixed frame-size. In the end of the signal processing chain, a stimulation pattern is generated for the current frame. As a consequence, the electrodes in the array are stimulated with a fixed rate independent of their frequency bands. In other words, the stimulation rate is dependent on and mostly equal to the frame rate of the incoming audio frames. In the

context of the ABCIT (Advanced Binaural Cochlear Implant Technology) project, we have developed a research interface for cochlear implants (Adiloglu et.al. IWAENC 14), which is now being extended with a capability to stimulate at a variable rate. Different methods of adapting the stimulation rate depending on the input signal are possible and will be evaluated with subjects in the future. One possible strategy to adapt the stimulation rate depends on fundamental frequency (F0) tracking. Here, we present how the adaptive stimulation part has been implemented and present first objective measurement results.

KEYWORDS: Cochlear implants, binaural, stimulation, variable rates

AUDITORY EVOKED POTENTIALS IN RELATION TO SPEECH PERCEPTION IN COCHLEAR IMPLANT LISTENERS

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INTRODUCTION: Auditory evoked potentials (AEP) can provide additional information on cortical activities and the central auditory performance. The main goal of this study was to measure the influence of the interstimulus interval (ISI) for cochlear implant (CI) users on cortical AEP along the cochlear.

MATERIALS and METHODS: 44 experienced CI-users took part in this study. The AEP-data was collected at vertex. Pulse trains of 300ms length were used as stimuli at three different electrodes covering the apical, medial and basal parts of the electrode array. Pauses in between stimulations were varied from 300ms, 900ms, 1400ms to 5000ms. The resulting AEPs were analyzed with regard to the N1-P2 complex and latencies.

RESULTS: The length of the ISI shows a significant influence on the verifiability of cortical evoked potentials. For all participants P1, N1 and P2 potentials could be determined for ISI=5000ms. A decrease down to 300ms led in ~32% cases to no determination of the P1, N1 and P2 potential. There is also a significant disparity of the N1-P2 complex within the cochlear. N1-P2 amplitudes at the more apical location are 1.5 times bigger than at the base. Speech comprehension scores (Freiburg monosyllabic test) correlate significantly with AEP parameters.

CONCLUSION: The N1-P2 amplitude differences for apical and basal electrodes may be related to the hearing loss progress prior to implantation. Increasing the stimulus rate results in lower potential amplitudes, which is evidently due to refractory cortical neurons. Single tone bursts can be used as indicator for speech understanding.

KEYWORDS: Cochlear implant, auditory evoked potentials, interstimulus interval

EFFECT OF PROCESSOR CONFIGURATION AND TELEPHONE COUPLING STRATEGY ON SPEECH RECOGNITION AND SATISFACTION IN ADULT COCHLEAR IMPLANT USERS

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Telephony is the cornerstone of modern, non-face-to-face communication, with over seven billion mobile and fixed-line telephone subscribers worldwide (Pramis, 2014). Unfortunately, advances in cochlear implant technology have not led to high levels of satisfaction on the telephone. A 2006 study by Anderson et al. reports that, among a sample of 196 cochlear implant users, 62% understand less than half of their daily telephone conversations. Similar results were reported more recently by Rigotti et al. (2013). Effective use of the telephone is made difficult through the absence of visual cues, band-limitations of signals, potential lack of familiarity with speaking partners, background noise, and inadequate coupling of the telephone to the speech processor, among others.

The purpose of this study was to evaluate the impact of processor configuration and telephone-to-processor coupling strategy on telephone-based speech understanding and satisfaction in noise for adult cochlear implant users. Sentence-based speech test signals were filtered (300-3400 Hz) to simulate telephone transmission signals and presented to participants over a handheld telephone receiver. Uncorrelated cafeteria noise was additionally presented via a three-loudspeaker array (50 dBA) into the test environment. Combinations varying in the usage of wireless streaming, functionality automation, directional microphones, noise reduction, and telecoil were compared in terms of their effects on speech understanding. Additionally, patients were asked to assess sound quality of voice samples via a visual analogue scale. Results suggest that processor configuration and telephone coupling strategy significantly affect telephone-based speech understanding and satisfaction and should, therefore, be optimized for CI-users during clinical fittings.

KEYWORDS: Cochlear implant, telephone, speech understanding, sound quality

COCHLEAR IMPLANT CANDIDATES WITH PSYCHOGENIC HEARING LOSS

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OBJECTIVE: To describe the phenomenon of patients with psychogenic hearing losses specifically requesting cochlear implantation (CI), and to gain first insights into the characteristics of this group.

MATERIALS and METHODS: Between 2004 and 2014 data on all patients, who requested a CI and presented themselves with very poor hearing threshold in routine audiometry, but showed considerably better thresholds when using objective tests.

RESULTS: In this 10-year-period, 4 patients matching the above requirements were seen at our center. All 4 patients were female, aged 23 to 51. Their hearing thresholds in pure tone audiometry ranged from 86 dB to 112 dB (pure tone average 500 Hz to 4000 Hz). In con-

trast, auditory brainstem responses (ABR) and otoacoustic emissions (OAE) suggested bilaterally normal hearing in two subjects, and hearing thresholds between 30 and 50 dB in the other two subjects. The histories of the subjects showed similarities. 3 suffered from depression, 1 believed to have a hidden cancer. Three had a history of 5 or more previous surgeries. All were hearing aid users at the time of presentation. In one case, no OAE were present and the psychogenic part of the hearing loss was only be confirmed by ABR.

CONCLUSION: Psychogenic hearing loss in order to receive a cochlear implant is a relatively new phenomenon. It seems to be rare but stresses the importance to confirm the hearing threshold with by measuring auditory brainstem responses. Numerous unrelated surgeries, depression or other psychiatric disorders seem to be overrepresented in this group.

KEYWORDS: Cochlear implantation, non-organic hearing loss, auditory brainstem responses, otoacoustic emissions

HEARING PERFORMANCE IN REAL LIFE LISTENING SITUATIONS BY INDIVIDUALS USING MED-EL AND VIBRANT-MED-EL HEARING IMPLANTS

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OBJECTIVE: Background noise and reverberant listening conditions lead to elevated listening effort and listening difficulties in daily life situations, especially for hearing-impaired people. The aim of this study is to evaluate hearing performance in real life settings for MED-EL and VIBRANT-MED-EL hearing implant users, respectively.

MATERIALS and METHOD: Using their individual everyday life hearing condition, 33 CI (unilateral, bilateral, EAS, SSD) and VSB (sensorineural HL, mixed HL) users participated in the study so far. Outcomes were taken at a single test visit in a sound-treated room. To evaluate the ability to recognize speech (Oldenburg Sentence Test) in alterable background noise the Roving Level Test (RLT) has been chosen. Additionally, the ability to determine subjects' maximum noise levels to just be able to follow conversation has been rated using the Just Understanding Speech Test (JUST). Furthermore, a Visual Analogue Scale (VAS) to measure a subject's self-assessed listening effort in a particular listening situation has been included in the study.

RESULTS: Nice correlation seems to exist between the outcome of the RLT and the JUST. These and other preliminary results of the study will be shown for the different implant and modality types compared to each other.

CONCLUSION: The measurement gives information about hearing ability and benefit in real life situations. In addition it remains to be seen if the JUST could be used appropriately for prospective clinical purposes because of its general advantage to be done for each hearing device due to flexible and individually selectable SNR (rated by the patient).

KEYWORDS: Cochlear implant, real life, background noise, speech understanding, listening effort

SWISS NATIONAL COCHLEAR IMPLANT REGISTER: ANALYSIS OF SOUND FIELD THRESHOLD IN CI USERS

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2444 Cochlear Implant surgeries have been performed in Switzerland from 1977-2013 at one of the five CI Centers i.e. Basel, Bern, Geneva, Lucerne and Zurich. Basic information about all implantations is anonymously stored in a national cochlear implant register. 2013 the implant register was extended to totally 154 items including medical history, social economic status, etiology as well as objective audiometric outcome. Additionally a webinterface was programmed to allow continuous collection of data during each visit of the patients. The collection of patient specific data in a central database with an annual conjoint report of all five CI centers is requested by the Swiss government.

We studied 1015 side-specific or bilateral thresholds from 755 patients. The patients used soundprocessors from Cochlear, Medel, Advanced Bionics or Oticon Medical. The averaged threshold for the frequencies between 250 Hz and 6000 Hz ranged from 24-28 dB HL (SD 7.1-14 dB). At 8000 Hz the averaged threshold was 43 dB HL (SD 24 dB). 130 Patient were equipped with the latest soundprocessors (CP900 N=115, Sonnet N=3, Naida=33 or Saphyr=2) showed similar results. The threshold for frequencies between 250 Hz and 6000 Hz ranged between 26-30 dB HL in mean and deviates also at 8000 Hz to 43.3 dB HL. This analysis includes

The Swiss National Cochlear Implant Register allows multiple analysis of an entire national Cochlear Implant Population.

KEYWORDS: Swiss National Cochlear Implant Register, aided threshold

CONTRALATERAL BIMODAL STIMULATION: A WAY TO ENHANCE SPEECH PERFORMANCE IN ARABIC SPEAKING COCHLEAR IMPLANT PATIENTS

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BACKGROUND: The combination of acoustic and electric stimulation as a way to enhance speech recognition performance in cochlear implant (CI) users has generated considerable interest in the recent years.

OBJECTIVE: The purpose of this study was to evaluate bimodal advantage of FS4 speech processing strategy in combination with hearing aids (HA) as a mean to improve low frequency resolution in CI patients.

MATERIALS and METHODS: Nineteen post-lingual CI adults were selected to participate in this study. All patients were implanted in one side and HA wearied on the contra lateral side with residual hearing. Speech discrimination, Speech in noise, emotional and talker identification were assessed using CI with FS4 strategy, HDCIS strategy, HA alone and combination of CI and HA.

RESULTS: The bimodal stimulation showed improvement in speech performance and emotion identification for question/statement/order which was statistically significant compared to patient with CI alone but, there were no significant statistical differences in intra gender talker discrimination and emotion identification for happy/angry/neutral tasks. The poorest performance was obtained with HA only and it was statistically significant compared to other modalities.

CONCLUSION: The bimodal stimulation showed enhanced speech performance with CI patients and it improves the limitations provided by electric or acoustic stimulation alone.

KEYWORDS: Cochlear implant, bimodal stimulation, hearing aids, enhancing speech performance

DOES VERBAL INTELLIGENCE RELATES TO SPEECH INTELLIGIBILITY IN COCHLEAR-IMPLANT USERS?

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Following cochlear-implant (CI) implantation, the (re-)acquisition of speech intelligibility is considered as a desirable result of CI rehabilitation. The successful adaptation of auditory cognition to the CI input depends to a substantial degree on individual factors. However, it is currently not well understood whether in CI users the observed differences in speech intelligibility and listening effort are related to working memory capacity (WMC) and/or linguistic competence. The aim of the present study was to investigate whether cognitive/linguistic competence relates to speech understanding with a CI. We recorded event-related potentials (ERPs) to study the neuronal processing of auditory stimuli at early and later processing stages in the auditory hierarchy. CI users' verbal working memory and lexical fluency were tested. Subsequently, their speech intelligibility in quiet/noise was assessed while having their EEG recorded. An active oddball paradigm was used. Participants were asked to press a button every time they heard a rare target word ($p = 0.2$) intermixed in frequent standard words ($p = 0.8$).

Preliminary results revealed a relationship between WMC/linguistic competence and ERP latencies for CI users. Effects of background noise were found on early and late ERPs. Latencies were shortest for speech in quiet. Further results will be presented on the relationship between speech intelligibility, listening effort and individual factors in CI users.

KEYWORDS: Cochlear implants, electrophysiology, speech intelligibility

THE EVALUATION OF LANGUAGE AND CORTICAL DEVELOPMENT OF THE COCHLEAR IMPLANT USER WITH POLYNEUROPATHY - CASE REPORT

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INTRODUCTION: Procuring language development of the patient with hearing impairment has vital importance to acquire the same speech and language development level with their peers who has normal hearing. Supporting the social, psychologic and motor skills is essential to have normal development as well as auditory-verbal support. Neuropathies can damage auditory and the other developmental areas during the newborn and early childhood process so it can be said neuropathies are serious obstructions for development. Although we often come across with auditory neuropathy in clinical practice, polyneuropaties, which affect different systems, are rare situations. The education of these children needs to be different from classical training methods. The purpose of the education system for the children with polyneuropathy is enhancing the performance by supporting all of the developmental areas composed of especially auditory and motor skills.

OBJECTIVE: The purpose of this study is investigating the effects of supporting the all of the developmental areas of polyneuropaty patients with hearing impairment which accompany the intense audiotory –verbal education and cortical development.

MATERIALS and METHODS: This study was conducted during the dates of April 2013 - March 2015 at Audiology department of ear,nose and throat department, Istanbul University. One girl patient with cochlear implant was recruited for this study. She had got bilateral severe sensorineural hearing loss and audiotory neuropaty and beside these she had polyneuropaty diagnosis from pediatric neurology department. The CI usage period is 24 months, the chronologic age is 6 years old. The patient participate the special education program in our departmant' education unit and special education center. She gets training of auditory-verbal education and sensory integration support.

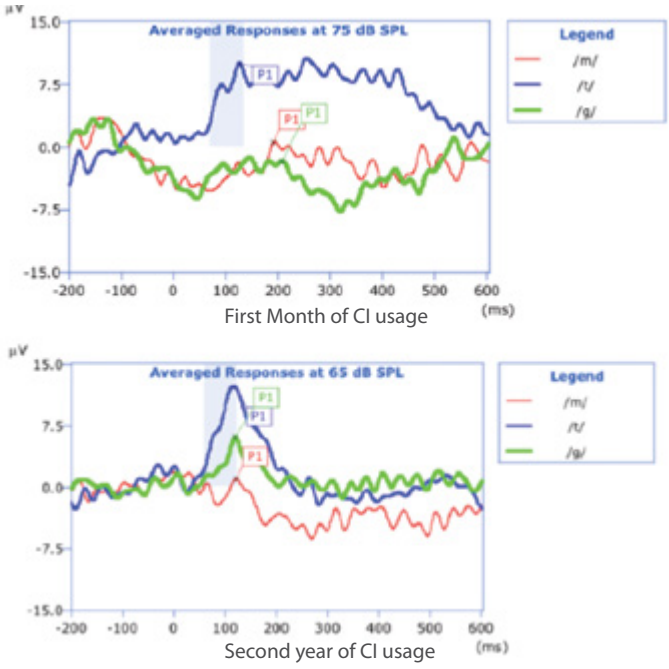

Figure 1. Cochlear implant, polyneuropathy, cortical responses

The patient was evaluated periodically with language development tests, audiologic assessments and auditory-cortical tests. EARS test battery was made use of testing auditory development. Free field audiometric tests was conducted with GSI61 clinical audiometer and auditory-cortical responses were evaluated with FRYE HearLab ACA .

RESULTS: It was found that intense auditory- verbal education (five day per week) and parent education significantly make a contribution to language and cortical development of the cochlear implant user patient's who has polyneuropaty diagnose.

KEYWORDS: Cochlear implant, polyneuropathy, cortical responses

COGNITIVE FUNCTION ASSESSMENT IN SCHOOL AGED CHILDREN WITH CHRONIC LUNG DISEASES USING AUDITORY EVENT RELATED POTENTIAL (P300) VERSUS STANFORD BINET TEST

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BACKGROUND: Chronic lung diseases in children represent heterogeneous groups. Those children are at risk of the adverse impact of chronic or intermittent hypoxia on their development, behavior and academic achievement. Although few researchers have investigated cognitive function in children with chronic lung diseases, the role of P300 in assessment of cognitive function was not investigated yet.

OBJECTIVE: This study was designed to assess the cognitive functions among children with different chronic lung diseases using both auditory P300 and Stanford Binet Test.

MATERIALS and METHODS: The study group consisted of 40 school aged children. They were suffering from chronic non-asthmatic chest trouble. The control group consisted of 30 healthy children with similar age,gender and socioeconomic state. All subjects were submitted to full history, complete clinical examination (chest examination and Anthropometric measures), radiological evaluation and spirometric tests. Audiological evaluation included (otological examination, pure- tone,speech audiometry and immittancemetry). Cognitive function was assessed by auditory P300 and Psychological evaluation using Stanford Binet Test (4th edition)

RESULTS: Children with chronic lung diseases had significant lower weight and height measures compared to the healthy control group. They had statistically significant lower IQ scores and delayed P300 latencies denoting lower cognitive abilities. Among diseased children more cognitive affection was correlated to the severity of the disease.

Many variables such as malnutrition, passive smoking and physiotherapy were affecting the cognitive function in those children rather than hypoxia alone.

CONCLUSION: Cognitive deficits in children with different chronic lung diseases was detected by both Stanford Binet Test and P300. Early and effective intervention is recommended to limit the adverse consequences of chronic lung diseases.

KEYWORDS: Chronic lung diseases, hypoxia, P300, Stanford Binet

TOWARDS AN OBJECTIVE MEASURE OF BINAURAL FUNCTIONING

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Normal hearing listeners integrate input from two ears (binaural hearing). This allows them to localize sounds and to understand speech, even under acoustically challenging conditions.

The goal of the present study is to determine an objective measure of binaural hearing. In a first phase, 14 young normal hearing participants listened passively to binaurally presented sinusoidal amplitude-modulated tones. This enabled us to investigate neural temporal coding by means of Auditory Steady-State Responses (ASSRs). Different modulation frequencies (20, 40 and 80 Hz) were used to assess the contribution of different neural generators. The stimuli were 4 seconds in duration, with opposite phase shifts of 90° in the two ears, recurring every 400 milliseconds. These IPD changes were expected to elicit a short distortion in the synchronization of the ASSRs, which was used as a measure of binaural functioning. Results showed stable ASSRs and significant change responses elicited by the phase shifts in all participants for the 40 Hz modulation frequency. However, significant change responses for 20 (more cortical) and 80 (brainstem) Hz were only observed in 11 out of 14 participants. Currently, another measure is being evaluated for those participants in which the first measure led to inconclusive results. These data will be presented at the conference. A robust and objective measure of binaural functioning would enable us to optimize hearing aid fitting or it could be used as a measure of central auditory processing.

KEYWORDS: Binaural hearing, objective measures, auditory steady-state responses

LATE TERM BILATERAL COCHLEAR IMPLANTATION - CASE REPORT

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ABSTRACT: This article reports a case of bilateral cochlear implantation in a 4 year-old girl who was diagnosed to have bilateral profound sensorineural hearing loss during newborn hearing screening program.

OBJECTIVE: The purpose of this study is to investigate the effects of late term bilateral sequential cochlear implantation.

MATERIALS and METHODS: This study was conducted between March 2014 and March 2015 at the Istanbul University, Departments of Otorhinolaryngology and Audiology and Istanbul Training and Research Hospital, Department of Otorhinolaryngology.

A four year-old girl was diagnosed to have bilateral profound sensorineural hearing loss during newborn hearing screening program. Following appropriate work-up, right-sided cochlear implantation was performed in 10th November 2011. Due to thinning and hyperemia of the skin overlying the internal magnet noted in June 2012, topical treatment was tried but no regression was seen. At follow-up examinations, displacement of the internal part was noted and reposition of the internal part was carried out under general anesthesia in 21st January 2013. Skin defect was repaired and reconstructed by local flap administration in 15th May 2013. In 6th June 2013 right-sided cochlear explantation and left-sided implantation were performed. Although the patient demonstrated a rapid progress in language development following first (right-sided) cochlear implantation, language acquisition and development arrested and even regressed after the second (left sided) cochlear implantation. The patient was reimplanted on the right side in 6th January 2015. The patient was evaluated periodically with language development tests, audiologic assessments and auditory-cortical tests. EARS test battery was utilized to evaluate auditory development. Free field audiometric tests were conducted with GSI61 clinical audiometer and auditory-cortical responses were evaluated with FRYE HearLab ACA.

RESULTS: The patient's auditory perception and language-speech assessment results before bilateral cochlear implantation are listed:

She distinguishes familiar (to be familiar with) monosyllabic, two-syllable and three-syllable words only auditory stimuli without visual stimuli (MTP12: 22/24, repeats the rhythm of drum (when made with only drum and bell), repeats familiar two words when evaluating the auditory memory and distinguishes sister's and her own name. She makes sentences consists of 2 – 3 word. Lack of clarity of speech intelligibility was observed. The patient's auditory perception and language-speech assessment results after bilateral cochlear implantation are listed: MTP12: 24/24, BIS12: 24/24. She repeats familiar three words when evaluating the auditory memory.

OTOACOUSTIC EMISSIONS IN CHILDREN WITH AUTISM

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OBJECTIVE: The aim of this study was to investigate otoacoustic emissions in children with autism compared with their typically developing peers.

MATERIALS and METHODS: Thirty-one children with autism (Mean age ± SD: 3,2 ± 0,8 years) and 17 typically developing control participants were examined (Mean age±SD: 3,5 ± 0,9 years). All participants had normal hearing (thresholds < 15 dB HL) and normal middle ear function. Since behavioral audiometry could not administered to many of the children with autism, auditory brainstem response (ABR) was used to detect hearing status, and Transient evoked otoacoustic emissions (TEOAE) and distortion product otoacoustic emissions (DPOAE) were measured in two groups.

RESULTS: No significant difference in TEOAE test results was found between the children in two groups. But S/N of high frequency DPOAE's was greater in children with autism compared to the control group ($p<0.05$).

CONCLUSION: Increased DPOAEs in high frequencies may be related to sound hypersensitivity that is reported in children with autism.

KEYWORDS: Autism, hearing, otoacoustic emissions, sound sensitivity

OBJECTIVE ESTIMATION OF LOUDNESS GROWTH FUNCTIONS USING AUDITORY STEADY-STATE RESPONSES

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Various hearing aid fitting rules aim to normalise loudness. However, due to difficulties measuring loudness growth functions in individual patients, simplified fitting rules including population averages are used. To measure the relationship between the physical intensity and loudness, its perceptual correlate, various behavioural methods can be used. However, they are often not used in clinical practice because they are time-consuming, complicated, and require an active cooperation of the patient. Usually only hearing thresholds are measured, which are just one point of the loudness growth function. This study

aims to develop an objective measure of loudness growth using the auditory steady-state response (ASSR).

Normal-hearing and hearing-impaired listeners participated in this study. Stimuli consisted of 40 Hz amplitude-modulated sinusoids with carrier frequencies of 500 Hz and 2000 Hz, presented at different intensities encompassing the participants' dynamic ranges. In the behavioural part of this study, loudness scaling and absolute magnitude estimation were conducted. In the objective part of this study, ASSRs were recorded for the same stimuli. Depending on the intensity, recordings were made during 5 or 10 minutes.

After normalisation, only small differences were found between behavioural and ASSR growth functions for normal-hearing and hearing-impaired participants. The ASSR can be used as a neural correlate of loudness growth in acoustic hearing.

KEYWORDS: Loudness growth, auditory steady-state responses, objective measure

MEASURING SYNCHRONIZED CORTICAL ACTIVITY TO SPEECH-ENVELOPE-LIKE FLUCTUATIONS

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Temporal fluctuations in speech are of major importance for speech intelligibility. In normal listening situations, the speech envelope alone is sufficient for accurate speech intelligibility. The speech envelope consists of modulations and fluctuations at frequencies mainly below 20 Hz.

The auditory steady-state response (ASSR) method is ideal to objectively measure the auditory pathway's response to speech-envelope-like fluctuations (0.5-20 Hz). ASSRs are stationary responses that are elicited by periodically varying or modulated sounds. A unique feature of ASSRs elicited by speech-envelope-like fluctuations is that they origin from the auditory cortices. As a result, auditory processing can be studied at the highest level of the auditory pathway. However, due to the clinical relevance for threshold determination, most studies focused on subcortical and brain stem ASSRs. Few studies have investigated cortical ASSRs. In order to interpret cortical ASSRs for studying speech processing knowledge about test-retest repeatability, and inter-subject variability of these responses is of major importance.

We studied the test-retest repeatability and inter-subject variability of cortical ASSRs with a 64-channel EEG set-up in ten young adults during two test sessions. During each test session, ASSRs were measured for 30 modulation frequencies ranging from 0.5-20 Hz with a 0.5-1 Hz step size. A 70 dB SPL, 100% modulated, 1 kHz one-octave band white noise stimulus was used. Results show unique underlying subject dependent synchronized activity patterns. The underlying synchronized activity patterns were, for all subjects, highly reproducible across test sessions.

KEYWORDS: Electrophysiology, objective measures, auditory steady-state responses, cortical responses

TURKISH TRANSLATION, TRANSCULTURAL ADAPTATION, RELIABILITY AND VALIDITY OF THE AMSTERDAM INVENTORY FOR AUDITORY DISABILITY AND HANDICAP: PRELIMINARY RESULTS

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INTRODUCTION: The aim of this study was to adapt the Amsterdam Inventory for Auditory Disability and Handicap (AIADH) into Turkish.

MATERIALS and METHODS: The AIADH includes 30 questions. Each question is divided into two subquestions. The "a" questions assess an individual's hearing disability and "b" questions provide as assessment of an individuals handicap. The AIADH covers 5 subscales.

First 3 English teachers independently translated the original questionnaire into English-Turkish and a consensus version was generated. Later, 3 other translators, performed a back translation. This version was then compared with the original English questionnaire. Final Turkish version was established by 3 audiologist. A pilot study of 20 normal-hearing subjects was conducted. No changes for questions were suggested. Therafter this questionnaire was administered to 50 participants. (Group 1; normal-hearing participants and Group 2; hearing-impaired participants. The inventory was re-administered to hearing-impaired participants. The Wilcoxon signed rank test was tested for the difference of the two tests.

RESULTS: Statistically significant differences were observed for the responses in all questionnaire subscales between Group1 and Group 2 participants ($p<.05$). The Wilcoxon sign rank test showed no statistical difference between the test and re-test scores in all questionnaire subscales ($p>.05$). Results of the present research showed that high test-retest reliability among hearing-impaired participants.

CONCLUSION: The questionnaire was able to differentiate between normal hearing and hearing-impaired participants. High test-retest reliability was also found. The study of Turkish adaptation of the AIADH will be continued with more participants.

KEYWORDS: Hearing, disability, handicap, Turkish, adaptation

EFFECTS OF AGE-RELATED HEARING LOSS ON SPEECH RECOGNITION WITH COMPETING TALKERS

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In many communication situations it is necessary to selectively attend to a target talker and to suppress information from competing talkers. It might also be necessary to divide attention to different talkers in order to gain multiple information. Meister et al. (Neuroscience, 2013) have shown that different cognitive functions, such as short term or working memory and fluid intelligence, are connected with speech recognition scores for selective and divided attention. Those findings based on data from listeners with clinically normal hearing thresholds.

The present examination additionally considers effects of typical age-related hearing loss. Two age-matched listener groups with and without hearing impairment were compared with regard to their speech recognition in a competing talker situation. The two talkers differed with respect to voice cues. With selective attention, the task was to recognize the sentences spoken by only one of the talkers whereas divided attention required the streaming of sentences from both talkers.

Compared to their normal-hearing peers, participants with hearing impairment showed inferior results for all of the tasks, though both groups revealed near perfect speech recognition in quiet. Worsening was similar for selective and divided attention tasks. In order to shed light on the underlying mechanisms, different error sources such as confusing, omitting or misunderstanding words, were investigated. The resulting error patterns are discussed against the background of established speech perception models regarding attention (Shinn-Cunningham et al., Trends Amplif, 2008) and memory functions (Rönnberg et al., Front Syst Neurosci, 2013).

KEYWORDS: Age-related hearing loss, speech recognition, attention, working memory

AUTOMATIC POSTURAL RESPONSES IN GERIATRIC POPULATION WITH FEAR OF FALLING

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OBJECTIVE: Automatic postural responses are very complicated in central nervous systems. With repeated perturbations, automatic postural responses occur and measure with different methods. Age, gender, environment changes and emotions affect results. Last published scientific researches persist on emotions and fear of falling and balance.

In this study, we designed to investigate the influence of fear of falling on postural responses in geriatric population

MATERIALS and METHODS: İn total 50 participants, experiment group (n=25, mean age=76) and control group (n=25, mean age= 77) paticipated voluntarily in this study. We performed Falls Self-Efficacy Scale (FES-I)- Turkish Version and Adaptation test with using computerized dynamic posturography for all participiants.

RESULTS: There was no statistically significant difference between fear of falling and automatic postural responces($p>0.05$) but also, automatic postural responses in case group was higher than control group and FES-1 scores

CONCLUSION: There are more than affect on automatic postural responses not only emotions and also aging and others. We can accept that fear of falling is important factor for daily facilities risks for geriatric populatıon.

KEYWORDS: Fear of falling, posturography, balance, automatic postural responses, aging

REFLECTIVE WRITING – FOR WHOM?

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Professional development and reflective development are, among others, two interdependent processes that are important for trainee audiologists. Reflective writing has been viewed as supporting these processes. However, recent research findings indicate, that the way in which reflective writing tasks are organised and assessed, may constrain the students' reflections. In an attempt to reduce this, we introduced follow-up mentor-student motivating interviews as the formative assessment. This study evaluates our implementation of this new pedagogical approach.

Over the last three academic terms, 177 reflective texts have been submitted by 46 students, and followed up by 5 mentors who mentored between four and 12 students each. These texts and the follow-up motivating interviews were analysed, and discussed in team meetings. The findings support this new pedagogical approach. At the group level, an increased degree of throughput of students was observed, in terms of a higher percentage of successfully completed degrees. At the individual level, our analysis indicates a) change/development of individual learning strategies, and b) re-/conceptualisation of the main goals with the Audiology programme studies. Moreover, some cases of problematic interaction issues between student-clinical supervisor has been revealed (and solved). From the students' point of view, the follow-up motivating interviews were, generally, highly appreciated. These follow-up interviews clarified the strengths and the weaknesses of the individual student's level of reflective development, and suggested an appropriate direction for further development.

In sum, the new pedagogical approach evaluated in this paper is a useful way to overcome some of the constraints previous research outlined.

KEYWORDS: Professional development, reflective development, reflective writing

AUDITORY NEUROPATHY SPECTRUM DISORDER: 4 YEARS FOLLOW-UP RESULTS

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INTRODUCTION: Auditory neuropathy spectrum disorder (ANSD) is a type of hearing loss characterized by abnormal auditory function and/or abnormal or near normal cochlear hair cell function. Difficulty hearing in noise and speech perception performance not compatible with reported residual hearing. Risk factors of that cause ANSD are neonatal anoxia, hyperbilirubinemia, mechanical ventilation, low birthweight, prematurity, and genetics. Case history, Auditory Brainstem Response (ABR), imittance measurements, Otoacoustic Emissions (OAE) and behavioral audiometry play an important role in diagnostic evaluation. Rehabilitation choices alter from FM system or hearing aids to cochlear implants or brainstem implants.

OBJECTIVE: The purpose of this study is to report follow-up results and risk factors that causes ANSD among children.

INCLUSION CRITERIA: Presence of OAEs and/or cochlear microphonic (CM); absent or altered ABR

MATERIALS and METHODS: This retrospective study was carried out between 2010 and 2014 and included the charts of 60 individuals with ANSD. Data from audiological examinations based on behavioral audiometry, impedance tests, otoacoustic emissions (OAEs), and Auditory Brainstem Response (ABR) are collected.

KEYWORDS: Auditory neuropathy spectrum disorder, pediatric audiology, auditory brainstem response

NEUROTOLOGIC SYMPTOMS IN FACTORY WORKERS WHO WORK IN THE NOISY ENVIRONMENTS

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AIM: The aim of this study was to compare of the results of (DHI) Dizziness Handicap Inventory and neurotologic symptoms in the factory workers who work in noisy environments and male volunteers who working in silent environment.

MATERIALS and METHODS: 40 male workers who had been working more than five years in noisy environments (equal to or above 85 dB) and age average was 41.05±7.59 were taken to this study. And 40 volunteer males whose working in silent environment and age average was 35.17±8.06 were added to control group. It was asked to all subjects to fill DHI and to answer all the questions about neurotologic symptoms.

RESULTS: In comparison to control group, study group showed statistically significant difference by means of DHI emotional, physical, functional and total scores ($p<.05$). ($p<.05$). As statistically significant differences were obtained between two groups from neurotologic symptoms in terms of headache, hearing loss and discomfort from loud sounds ($p<.05$).

CONCLUSION: DHI scores were obtained so high in the male workers who are working in the noisy environments. It was determined that headache, hearing loss and discomfort from loud sounds were seen so much in these workers.

KEYWORDS: Workers, dizziness handicap inventory, noise, neurotologic symptoms

BEFORE AND AFTER THE REHABILITATION OF PATIENT WITH SUPERIOR SEMICIRULAR CANAL DEHISCENCE, COMPARE WITH VIDEO HEAD IMPULS TEST;CASE REPORT:

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INTRODUCTION: Video head impulse test which assess bilateral vertical and horizontal canals are effective test for patients who have semicirculer canal disfunction. This test is also used to evaluate the functions of semicircular canal before and after the surgery of superior semisirculer canal dehiscence. Aim of this study is comparison of video head impulse test (vHIT) results of the patients who have superior semicirular canal dehiscence which are obtained from before and after vestibular rehabilitation.

MATERIALS and METHODS: A 48 years old male patient was operated due to a cholesteatoma from his left ear. During the surgery his left superior canal integrity was damaged.The peripheric vestibular results of postoperation period was recorded with vHIT. The patient was integrated into a vestibular rehabilitation program during postoperation period. The vHIT was repeated at this process.

RESULTS: The presence of catch-up saccade latency was observed in a long latency of 1 month after surgery. Patient was included in the vestibular rehabilitation program for the next four months. vHIT results were obtained before and after rehabilitation and discuss to show the rehabilitation effects.

KEYWORDS: Vestibular, Vestibular rehabilitation, Semicircular canal dehiscence, Video head impulse

STABILITY OF AUDITORY STEADY-STATE RESPONSES OVER TIME

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Auditory steady-state responses (ASSR) are used in clinical practice to detect hearing thresholds in difficult-to-test patients, such as infants and patients with an intellectual disability. Typically, if the stimulus is just audible, the ASSR can be detected after a measurement of around 2-5 minutes depending on carrier wave and modulation. It is assumed that the ASSR amplitude is stable over time, during one measurement. However, stimuli used for ASSR measurements can

perceptually show loudness adaptation, which is a decrease in loudness judgment, while the intensity of the sustained stimulus remains fixed during several minutes. We investigated the stability (or adaptation) of the objective ASSR over time and the relation with perceptual loudness adaptation.

Fifteen normal-hearing adults participated in this study. Loudness adaptation was measured using a successive absolute magnitude estimation task, in which listeners had to give a number that corresponded to the loudness of the stimulus at regular intervals. ASSRs were evoked by 40 Hz mixed-modulated sinusoids with carrier frequencies of 500 Hz and 2000 Hz at 30 dB SL (soft level), which were also used in the first task. For data analysis, the ASSR amplitudes were calculated at intervals of 5.12 s.

Results indicated that the stimuli used for ASSR measurements caused loudness adaptation. The ASSR amplitudes remained stable over time for the 2000 Hz condition, but significantly decreased for the 500 Hz condition. This might have clinical implications for objective hearing assessments.

KEYWORDS: Auditory steady-state responses, loudness adaptation, objective hearing assessments

INVESTIGATION OF THE EXISTING TESTING PRACTICES IN THE AUDITORY BRAIN-STEM RESPONSE (ABR): AN ONLINE SURVEY

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OBJECTIVE: The purpose of this study is to examine the current practices in performing auditory brainstem response testing and to investigate the extent to which ABR testing practice is consistent with the existing published protocols.

MATERIALS and METHODS: An online survey regarding ABR testing protocols was distributed to participants. The survey consisted of 69 questions divided into four sections: demographic information, general testing protocol, adult testing protocol and children testing protocol.

RESULTS: 94 audiologists who regularly perform ABR testing participated in the study, 79 of whom completed the whole survey, yielding a completion rate of 84%. Almost half of the participants indicated that they do not administer ABR testing in a sound treated room, over two-thirds of the audiologists stated that they do not use masking when performing air conduction testing and more than half of the participants do not convert ABR threshold into behavioral threshold. Each of these is inconsistent with the published protocols for ABR testing. There is also variation in regards to the definition of training period audiologists reported to undertake before the start of the ABR testing independently.

CONCLUSION: There is a need to place more emphasis on the importance of following published, evidence-based ABR testing protocols.

KEYWORDS: Auditory brainstem responses, protocols, consistency

RELATIONSHIP BETWEEN AIDED CORTICAL AUDITORY EVOKED RESPONSES AND AIDED BEHAVIORAL THRESHOLDS

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The cortical auditory evoked response is the neuroelectric response of the auditory system in the brainstem, midbrain, and the cortex to sound stimulation. Cortical auditory evoked potentials are a noninvasive, objective measurement that can provide detailed information about central auditory nervous system. They can be used for evaluation of hearing aid functionality. The present study aimed to determine the relationship between aided cortical auditory evoked potentials and aided behavioral thresholds. Therefore, 20 subjects, age ranging 4-8 years old, who diagnosed with moderate/ moderately severe hearing loss were included to the study. Pure-tone audiometry was performed using supra-aural earphones. After control of hearing aids, aided behavioral thresholds were determined in free field. After behavioral testing, cortical auditory evoked potentials testing was carried out. A strong correlation was found between aided cortical auditory evoked responses and aided behavioral thresholds in free field. These findings provide support for the use of cortcal auditory evoked potentials in measuring hearing aid benefit in clinical rotuine.

KEYWORDS: Cortical auditory evoked potentials, mild to severe hearing loss, hearing aid

THE EFFECT OF MINI MICROPHONE USE ON CORTICAL AUDITORY EVOKED RESPONSES IN NUCLEUS 6 USERS

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Nucleus 6 has wireless accessories including a remote microphone (Cochlear Mini Microphone) which delivers the auditory signals directly to the cochlear implant user's speech processor via digital radio frequency.Cochlear implant recipients have high levels of speech understanding in quiet environments, however their ability to understand speech is compromised in noisy situations.

The use of Cochlear mini microphone aims to enhance speech recognition, sound quality, and the overall listening experience in difficult to listen situations.

The aim of the study is to evaluate the effect of mini microphone in noisy situations with cortical potentials.

10 cochlear implant recipients took part in the study.The age range was 17 to 65 years. All patients have at least one year experience of cochear implant use. P1N1P2 responses were recorded in four conditions with speech stimulus /da/: in quiet with Nucleus 6 alone and Nucleus 6+ mini microphone; in noise with Nucleus 6 alone and Nucleus 6+ mini microphone.

The P1N1 P2 latencies obtained through 4 test situations will be reported. The comparison of quiet and noise situations will be pre-

sented and implications for these outcomes and the use of the mini microphone will be discussed.

Cortical auditory evoked potentials reflect the performance after cochlear implantation and provide an objective way to evaluate postoperative cortical auditory performance in both quiet and noisy environments

KEYWORDS: P1 latency, cochlear implants

A FAST METHOD FOR THE PSYCHOPHYSICAL ESTIMATION OF NONLINEAR COCHLEAR FUNCTION USING SCHROEDER-PHASE MASKING

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The power spectrum model of masking (Patterson and Moore, 1986) assumes that the masking ability of a sound is affected only by the frequency and intensity of the masker, but not the phase. The well-documented difference in masking produced by different phases of Schroeder-phase harmonic complexes the ("phase effect") is thought to be contributed by the phase curvature of the auditory filter and nonlinear cochlear processing (Kohlrausch & Sander, 1995). We have recently developed a fast method for recording Schroeder-phase masking functions in humans which takes 8 minutes of testing time rather than the 45 minutes taken by the conventional three alternative forced choice (3AFC) method. We demonstrate here the reliability of this new method and its potential use in measuring cochlear non-linearity.

Schroeder-phase masking functions were measured in 38 normal hearing and 15 hearing impaired participants using the conventional and fast methods. Results from our fast method agreed well with those from the conventional 3AFC method. We also used the fast method to measure functions at 0.25, 0.5, 1, 2, and 4 kHz at 45 and 75 dB A masker levels in normal hearing and hearing impaired participants, and found significantly reduced phase effects at low presentation levels and in participants with SNHL compared to normal hearing participants ($p<0.05$), consistent with reductions in cochlear nonlinearity in those conditions.

With an 80% reduction of testing time as compared to the conventional method, the fast method has great potential to aid future studies estimating nonlinear cochlear function.

KEYWORDS: Békésy tracking, Schroeder-phase masking, cochlear nonlinearity

MISMATCH NEGATIVITY: TEST-RETEST STUDY OF FIVE STIMULUS PARADIGMA

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Mismatch negativity (MMN) was developed by Nantaanen, and et al. at 1975. The mismatch negativity (MMN), a change-specific component of the auditory event-related potential (ERP), is elicited by any discriminable change in auditory stimulation irrespective of the subject or patient's attention or behavioural task. It provides an objective index for sound-discrimination accuracy at the cortical level and represents a neural plasticity. The present study aimed to evaluate the test retest reliability of MMN elicited by multi-feature paradigm which is developed in Hacettepe University. Twenty-four healthy volunteer subjects, all above the age 18, are taken the MMN test in Hacettepe Universi-

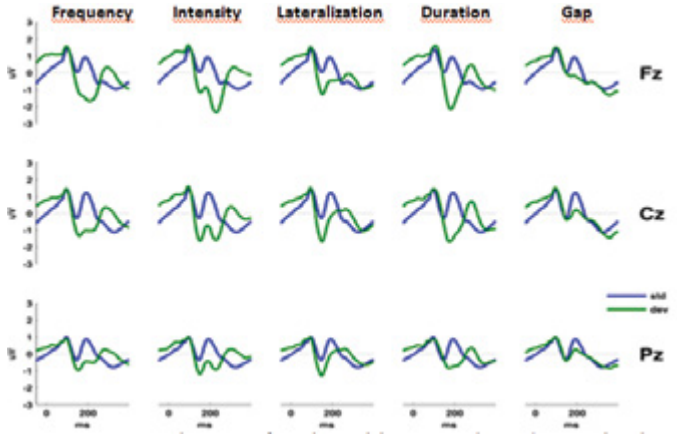

Figure 1. Responses due to standart and deviant stimulus of all paradigmas

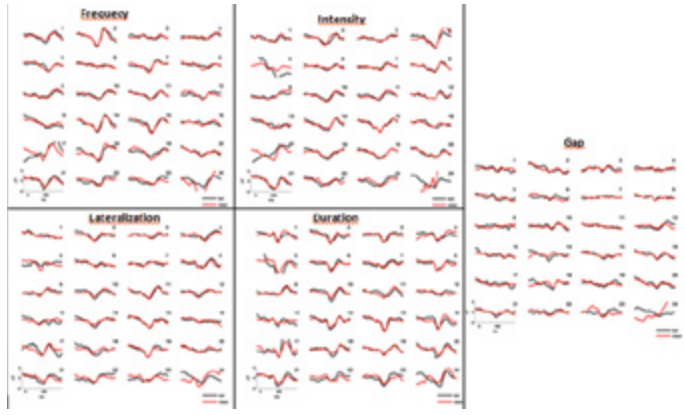

Figure 2. Test-retest comparison of responses in all paradigmas (Electrode of Fz)

Table 1. Mean SD and P value amplitutes 10 records (N: number participants, SD: standart deviation, p: co-efficient of t test

		Measurememt	N	Mean	SD	p
10 Records	Frequency	Test	21	-2.72	0.43	0.214*
		Retest	21	-2.96	0.36	
	Intensity	Test	21	-2.73	1.00	0.419*
		Retest	21	-2.83	1.01	
	Lateralization	Test	21	-2.12	0.83	0.678*
		Retest	21	-2.05	0.77	
	Duration	Test	21	-3.3	1.12	0.391 *
		Retest	21	-3.14	1.10	
	Gag	Test	21	-1.7	0.96	0,101*
		Retest	21	-1.36	0.59	

(*p>0,05)

Table 2. Mean SD and P value of latencies refer 10 records (N: number participants, SD: standart deviation, p: co-efficient of t test)

		Measurememt	N	Mean	SD	p
10 Records	Frequency	Test	21	194.67	16.85	0.458*
		Retest	21	192.14	11.40	
	Intensity	Test	21	198.64	12.56	0.210*
		Retest	21	193.88	16.42	
	Lateralization	Test	21	170.71	23.68	0.592*
		Retest	21	168.33	22.06	
	Duration	Test	21	188.43	24.44	0.573*
		Retest	21	183.81	27.96	
	Gag	Test	21	185.07	10.74	0.938*
		Retest	21	184.90	8.19	

(*p>0,05)

ty Audiology and Speech Pathology Department, electrophysiology laboratory. Duration of test retest was one week. 5-stimulus version of multi-feature MMN paradigma was developed according to research of Naantanen and et al. (2004). The deviant stimulus in the original 5-stimulus version ('Optimal-5') differed from the standard tones in frequency, duration, intensity, perceived location of sound origin or contained a gap in the middle of the tone. The data obtained indicate high level replicability of 5 stimulus MMN. In conclusion, the test rest-est reliability of MMN found in this study promotes the usefulness of the MMN in audiology and speech pathology fields.

KEYWORDS: Mismatch negativity, test retest, reliability, optimal appliance

TOWARDS A SCALABLE, BINAURAL HEARING DEVICE: ACOUSTIC TRANSPARENCY INTERACTS WITH INTERAURAL PROCESSING

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To provide help for listeners in acoustic "difficult" situations like Cocktail parties, elements of an assistive listening device will be reviewed that both fits the requirements of near-to-normal listeners and can be scaled up to a complete hearing aid for a more substantial hearing loss. Such a system should provide benefit in noisy situations or other daily life acoustical challenges using the concept of acoustically "transparent" earpiece in combination with algorithms for interaural cue enhancement and interaural coherence processing as well as other innovative hearing aid features.

The current prototype runs on the binaural, cable-connected master hearing aid (MHA) that includes earpieces allowing for approaching acoustic transparency. This can be achieved by an appropriate electro-acoustic model of the earpiece in connection with the individual ear canal and the digital filter derived from calibration requirements. A binaural high-fidelity enhancement algorithm motivated by interaural magnification is evaluated in its benefit for normal and near-to-normal listeners in comparison to a standard single-channel noise reduction algorithm. While the binaural enhancement scheme does not provide much benefit with (simulated) behind-the-ear-devices or in the closed ear canal condition, the quality evaluation shows a clear advantage if the binaural enhancement is combined with acoustic transparent earpieces. This interaction indicates that the benefit from binaural hearing device processing schemes might be underestimated if the acoustic presentation quality is limited.

KEYWORDS: Hearing aid, quality evaluation, binaural enhancement, noise reduction

COMPARE TO RISK FACTOR BETWEEN NORMAL AND FERTILIZATION IN VITRO BABY

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INTRODUCTION: Normal hearing in early infancy is essential for speech, language, and social and emotional development of human beings. The usual age at diagnosis of hearing loss is at least 18-30 months (or even later in cases of less severe hearing loss) when there are no screening programs in use.

The advent of technologic improvements in assessing the hearing of newborn infants has made possible the implementation of national newborn hearing screening.

As a direct result of hearing screening programs, both the age of identification of hearing loss and ageat entrance into intervention programs are dropping from anaverage two-year age level to within the first few months of life.

Previous studies showed that risk of low birth weight, low gestational age, preterm birth, perinatal morbidity and hospital admission is higher for fertilization in vitro infants than naturaly fertilization babies. Regard to these findings, we think that fertilization in vitro is risk factor for hearing loss.

Our goal is to investigate whether the fertilization in vitro carries a risk in terms of hearing babies.

MATERIALS and METHODS: This study is conducted at Cerrahpasa Faculty of Medicine, Department of Audiology, University of Istanbul between the dates of January 2014 to March 2015. The study is included, 3395 naturaly fertilization infant and 33 fertilization in vitro infant.

All of them are screened at Hearing Screening Unit of Cerrahpasa Faculty of Medicine, Department of Audiology. Infants who failed the screening test were followed up diagnostically.

RESULTS: 3352 of naturaly fertilization infants were passed the hearing screening test, 43 of them who failed the screening test were started use hearing aids. 27 of fertilization in vitro infants were passes the hearing screening test, 4 of them failed the screening test so the

were followed up diagnostically. And 1 infant baby was diagnosed with hearing loss. He has a profound hearing loss. Now he use cochlear implant.

BINAURAL SPEECH INTELLIGIBILITY IN NOISE AND REVERBERATION IN YOUNG AND OLDER NORMAL-HEARING AND HEARING-IMPAIRED LISTENERS

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The present study addresses the contribution of hearing threshold and suprathreshold deficits to the spatial and temporal processing of a single speech reflection. The relative importance of hearing threshold versus suprathreshold processing is assessed by the comparison of speech intelligibility across young and older normal-hearing listeners and hearing-impaired listeners. The hearing status was assessed based on pure tone threshold.

A series of binaural speech intelligibility measurements was performed in different noise conditions (frontal, diffuse, or lateral) and a single speech reflection arriving with a delay of 0, 50 or 200 ms after the direct sound.

The main findings were that the binaural gain in the presence of non-frontal interferers was independent of reflection delay and that the temporal processing of a single reflection was similar in each noise condition. However, the speech reception thresholds were higher in older normal-hearing and hearing-impaired listeners than in young normal-hearing listeners. Moreover, in both groups of older listeners the binaural gain was considerably reduced and the detrimental effect of a late reflection was larger than in young normal-hearing listeners. The increase in speech intelligibility thresholds and the reduction of binaural gain was more prominent in hearing-impaired listeners than in older normal-hearing listeners. These findings indicate that other factors than pure tone threshold are of great importance for speech intelligibility in noise especially in older listeners.

To quantify to what extent reductions in speech intelligibility can be explained by the pure tone audiogram, the data are compared to predictions of a binaural speech intelligibility model.

KEYWORDS: Speech intelligibility in noise, hearing-impaired listeners, older normal-hearing listeners, suprathreshold deficits

HIGH FREQUENCY HEARING LOSS IN SCHOOL-AGE CHILDREN

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BACKGROUND: It is reported that the prevalence of high frequency hearing loss (HFHL) has increased among school-aged children, and it may result from exposure to loud noise such as recreational activities. Failure to identify students with even mild HFHL may have long-term consequences.

OBJECTIVES: The aim of the study was to assess the prevalence of HFHL and its educational consequences in school-age children.

MATERIALS and METHODS: Results of audiometric pure tone threshold screening of almost sixty thousand first and six-grade students from primary schools in Warsaw were included into the study. Testing was performed at octave band frequencies from.5 to 8 kHz. The definition of HFHL included four, non-overlapping categories of hearing loss: two categories of sloping hearing loss within frequency range from 1 to 8 kHz and two categories of one frequency only hearing loss. School achievements were assessed with the use of the questionnaire administered to parents and teachers.

RESULTS: High frequency hearing loss of different type was present in 3% of tested children. 8 kHz was the most often and most seriously affected frequency. In the group educational problems were observed twice more frequently than in children with normal hearing.

CONCLUSION: The results indicate the substantial prevalence of high frequency hearing loss in school-age children and its negative educational consequences.

KEYWORDS: High frequency hearing loss, school-age children, hearing screening

INITIAL FINDINGS FROM A RETROSPECTIVE STUDY OF AUDIOLOGICAL THRESHOLDS IN CHILDREN WITH CRANIAL RADIOTHERAPY IN COMBINATION WITH PLATIN-BASED CHEMOTHERAPY

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Cranial Radiotherapy (CRT) is a common aspect of treatment for brain tumours in childhood. Larger cochlear dose of radiation correlates with greater hearing loss (eg. Hua et al, 2008), especially in combination with Cisplatin chemotherapy (eg. Paulinho et al, 2010). Animal studies and clinical studies in adults suggest asymmetrical hearing loss (Miller et al, 2007; Van der Putten, 2006).

We initiated a retrospective study in a pediatric population with brain tumours to investigate the effects of CRT on audiological thresholds,

as part of our involvement in PANCare-Life. Initial results include a comparison of post-chemotherapy thresholds of 186 patients (57 who had CRT, 129 who did not) to investigate progressive audiological changes after cessation of platin treatment. Thresholds were categorized according to the Münster system, focusing on minimal high-frequency changes (Schmidt et al, 2007).

No significant difference was found in the number or degree of bilateral threshold changes between CRT and non-CRT groups. A robust tendency ($p = 0.05$, Fisher's exact) towards asymmetrical deterioration was found in the CRT group, alongside decreased likelihood of threshold improvement. These initial results support the suggestion that CRT can lead to asymmetrical post-treatment deterioration in hearing thresholds in children and underline the necessity of audiological follow up after cessation of platin therapy, especially in children with combined cranial irradiation.

The 57 CRT patients were treated using various radiotherapeutic methods. We identified 31 children treated in the last 5 years with a single radiotherapeutic approach as the basis for a further study to substantiate our observations.

KEYWORDS: Cranial radiotherapy, hearing loss, platin-based chemotherapy

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.

MATERIALS and 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.

CONCLUSION: 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%.

Administration of ototoxic drugs for more than 7 days has a significant statistical importance in the ethiology of prelingual hearing loss in our study ($p<0.001$).

KEYWORDS: Aminoglycoside ototoxicity, newborn hearing screening

CARDIOVASCULAR RISK FACTORS AND HEARING LOSS: A COHORT STUDY (HUNT)

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Sufficient circulation is essential for the hearing function. While hearing loss has been associated with cardiovascular risk factors, prospective data are scarce and the potential of prevention is disputed. The purpose of the present paper was to examine the association between prospectively assessed cardiovascular risk factors and hearing loss in a population-based cohort study of 31,547 subjects. The subjects underwent pure-tone audiometry and had self-reported or measured cardiovascular risk factors assessed both 11 years before and simultaneously with the audiometric assessment. Hearing was assessed by pure-tone averages at low (0.25-0.5 kHz), middle (1-2 kHz), and high (3-8 kHz) frequencies. Cardiovascular risk factors were smoking, alcohol use, physical inactivity, waist circumference, body mass index, resting heart rate, blood pressure, triglycerides, serum cholesterol, HDL cholesterol, and diabetes. After adjustment for age, sex, level of education, income, recurrent ear infections, and noise exposure, risk factors associated with poorer hearing sensitivity were smoking, diabetes, physical inactivity, resting heart rate and waist circumference. Smoking was only associated with hearing loss at high frequencies. The effects were very small, explaining only 0.2-0.4% of the variance in addition to the component explained by age and the other cofactors. This cohort study indicates that, although many cardiovascular risk factors are associated with hearing loss, the effects are small and of doubtful clinical relevance.

KEYWORDS: Epidemiology, hearing loss, cardiovascular risk factors

WIDEBAND ACOUSTIC IMMITTANCE (WBI): INSTRUMENT, GENDER AND ETHNICITY SPECIFIC NORMATIVE DATA

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In order for WAI to become an effective diagnostic tool for use in clinical settings, normative data needs to be established. This pre-

sentation has investigated whether WAI values differ significantly in a normal hearing young adult population based on gender, ethnicity and instrument used to make measurements. Eighty normal hearing young adults (age 18-34) were recruited to undergo WAI testing with four different devices, Otostat Mimosa Acoustics, Titan Interacoustics, Reflwin Interacoustics and Mimosa Acoustics HearID. Out of the eighty participants, twenty participants were recruited from each of the male, female, Caucasian and Chinese groups. Across all groups and conditions, power absorbance (PA) values (the most commonly used WAI measurement) was decreased with decreases in frequency before the absorbance maximum (the frequency at which absorbance is closer to one) and decreased with increases in frequency after the absorbance maximum. PA values was lower in the low frequencies for the Chinese group in comparison with the Caucasian group and lower in the high frequencies for the Caucasian group as compared to the Chinese group. Body Mass Index (BMI) and ear canal volume was used as co-variant to explain these differences. PA values at peak pressure was statistically different from PA values at ambient pressure which may have an impact on diagnosis of stiffening pathology such as otosclerosis. While there were statistical differences between different instrumentation, the differences observed were smaller than differences that observed between PA values in normal group and PA in different middle ear pathologies.

KEYWORDS: Wideband acoustic immittance, WAI, power absorbance, PA, middle ear, instrumentation, gender, ethnecity

EFFECT OF KOREAN RED GINSENG ON NOISE-INDUCED HEARING LOSS IN RATS

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Noise-induced hearing loss is one of the most common causes of deafness and, at present, there is no treatment for the recovery of the normal hearing threshold after prolonged exposure to loud acoustic stimuli and the generation of acoustic trauma. The aim of this study was to evaluate the otoprotection efficacy of Korean Red Ginseng (KRG) against noise induced hearing loss in a rat animal model.

Twenty-eight male Wistar rats were used for this study and divided four groups. Group I (n=7), normal control group: animals did not undergo any treatments, group II (n=7), experimental control group: animals were exposed to noise, but weren't treated with KRG. Group III (n=7), experimental group: animals were administered KRG (200 mg/kg/day) for 10 days per 24 h by gavage after exposed to noise. Group IV (n=7), KRG control group: animals administered only KRG for 10 days. 14 rats (Group II and III) were exposed to 120 dB SPL octave band noise centred at 4 kHz for 5 h. The hearing status of all animals was evaluated with auditory brainstem responses (ABR) at 4, 8, 12, 16 and 32 kHz octave frequencies. ABRs were measured before and after noise exposed at 1st day, 7th, and 10th days.

ABR results demonstrate that the KRG group showed reduced threshold shifts compared with the control group after noise exposed. These shifts were significantly different between groups at 8 and 12 kHz ($p<0.05$), corresponding to the region most represented by the frequency of the traumatic noise.

KEYWORDS: Noise-induced hearing loss, antioxidants, Korean Red Ginseng

THE VALUE OF AUDITORY STEADY-STATE RESPONSES IN ESTIMATION HEARING THRESHOLDS IN ADULTS WITH SENSORINEURAL HEARING LOSS

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PURPOSE: The need for an objective tool to efficiently predict the audiogram caused that the use and importance of auditory steady-state response (ASSR) method is growing in recent times. The aim of study was the comparison of hearing thresholds estimated by ASSR with those obtained by auditory brainstem response (ABR) and pure-tone audiograms (PTA) in adults with different degree of sensorineural hearing impairment.

MATERIALS and METHODS: We tested 82 ears, which were assigned to different groups of hearing loss based on their pure-tone audiometry threshold (normal, mild, moderate, severe/ profound). Four frequencies (500 Hz, 1000 Hz, 2000 Hz, 4000 Hz) were evaluated with PTA, ABR and ASSR.

RESULTS: It was found that the mean values of PTA, ASSRs and ABRs thresholds did not differ significantly across all frequencies only in severe/profound hearing loss. 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. The best correlations between all methods we observed for 2000 and 4000 Hz.

CONCLUSION: 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

KEYWORDS: Auditory steady-state response, hearing threshold, sensorineural hearing loss

NEW METHOD FOR MEASURING THE CORTICAL AUDITORY EVOKED POTENTIALS: THE HEARLAB

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INTRODUCTION: Cortical auditory evoked potentials can provide objective information about the highest level of the auditory system. The purpose of the authors was to introduce a new tool, the "HEARLab" which can be routinely used in clinical practice for the measurement of the cortical auditory evoked potentials. In addition, they wanted to establish standards of the analyzed parameters in subjects with normal hearing.

SUBJECTS and METHODS: 25 adults with normal hearing were tested with speech stimuli, and frequency specific examinations were performed utilizing pure tone stimuli.

RESULTS: The findings regarding the latency and amplitude analyses of the evoked potentials confirm previously published results of this novel method.

CONCLUSION: The HEARLAb can be a great help when performance of the conventional audiological examinations is complicated. The examination can be performed in uncooperative subjects even in the presence of hearing aids. The test is frequency specific and does not require anesthesia.

KEYWORDS: CERA, HEARLab, hearing screening

EVALUATION OF POSTOPERATIVE PATIENTS COCHLEAR IMPLANTED ELECTROPHYSIOLOGICAL AND BEHAVIORAL RESPONSES

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GOAL: Patients, who had a cochlear implant operation, react the sound before neural response which acquire on the first programme. Considering of the first reaction of electrical stimulus, neural response and T, C levels which acquired after the neural response is important for choosing the suitable programme and the rehabilitation. The aim of this study is, researching the connection between the patients' first reaction of sound, neural response and T, C levels.

MATERIALS and METHODS: In this study we investigated 8 post lingual adult and adolescent patients who gave confidential responses. After an operation, we contained the first react of electrical stimulus, neural response, electrical T and C levels, T and C levels which depends on the patients' satisfaction of live sound in the first fitting and the first month programme. The relationship between these data was analyzed statistically.

RESULTS: Our patients are 4 female and 4 male. The average of age is 18, 5. There are significant differences between the first fitting and the first month programme mean values of 22. Electrical M level, 22-16-11-1. Electrical C levels which depends on the patients' satisfaction of live sound (Mann-Whitney Test $p<0.05$). In addition, there are statistically significant correlations between the values of the first react of electrical stimulus, neural response, electrical T and C levels, T and C levels which depends on the patients' satisfaction of live sound (Spearman Correlation Tests $p<0.05$)

CONCLUSION: When patients' programme is changed by the way of objective neural responses, they comprehend the live sound irritating. Because of that, the first response of electrical stimulus is an important parameter of fitting on patients who especially have good cooperation.

DIFFERENT CRITERIA FOR DETECTION OF TRANSIENTLY EVOKED OTOACOUSTIC EMISSIONS IN SCHOOL CHILDREN

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Transiently evoked otoacoustic emissions (TEOAEs) are currently widely used in newborn hearing screening programs. It seems logical to extend this type of test for other age groups. The particularly critical moment in development is age in early classes of school. The purpose of the present study was to test most popular criteria for detection of TEOAEs in school children. Otoacoustic emissions (OAEs) were recorded from the ears of school children. Global and half-octave-band values of TEOAE reproducibility, signal to noise ratios (SNRs) and response levels were used for analyses. Several criteria based on these parameters were tested. As a reference results of impedance and pure tone audiometry were used.

KEYWORDS: Otoacoustic emissions, OAE, school children

COMPAIRING ARLT RESULTS OF NORMAL AND SUBJECTS WITH TINNITUS

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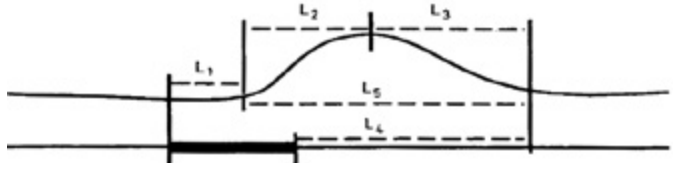
ARLT is one of the batteries which is used for differentiation of cochlear - retrocochlear pathology. It is the time interval between the start of an auditory stimulus and the start of the contraction of middle-ear muscles responding to that stimulus.

This is one of the supportive tests for differentiating pathologies, indicating suspicion of retrocochlear pathology (cerebellopontine angle tumors etc.), which are affecting the auditory nerve and auditory pathways. In the case of retrocochlear pathology, an increase in the latency of ARLT wave is observed.



L1 = The latency from start of stimulus to the first reflex response

L2 = The latency from the first response to peak of response

L3 = The latency from peak of response to the point where reflex reaches a 95% return to the reference line.

L4 = The latency from end of stimuls to the point where reflex reaches a 95% return to the reference line.

L5 = Overall reflex response time (L2+L3).

PURPOSE: Measuring the sensitivity and normalization of ARLT. And comparing the results with ARLT threshold of Tinnitus patients.

MATERIAL and METHODS: This study is conducted in Cerrahpasa Faculty of Medicine, Department of Audiology, University of İstanbul between Januray 2014 and March 2015

The study is conducted with 19 participants without tinnitus problem (38 ears) with normal examination findings and pure tone thresholds within regular boundaries. All of them have type A tympanograms. And 28 patients with tinnitus problem (56ears) with normal examination findings and pure tone thresholds within regular boundaries. All of them have type A tympanograms too.

RESULTS: ARLT latancy of the patients with tinnitus found smaller than the normal participants.

MIDDLE EAR REZONANT FREQUENCY NORMALIZATION ON NEWBORNS

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AIM: Middle ear resonant frequency provides maximum vibration with minimum energy in the system of tympanic membrane and ossicles. At the same time, transmission of sound from the middle ear to the cochlea is maximum at resonant frequency. [1] There are two factors which affects resonant frequency. These are; mass and stiffness. Acording to newborns maturation steps, external ear, middle ear and cochlea vary significantly in their acoustic response properties.

In that period, the external auditory meatus increases in size, the orientation of the tympanic membrane changes, and the middle ear mass decreases, among other changes. Newborns resonant frequency under influence of mass factor mostly. Nonetheless, this factor is known that which affects the test results.

The resonant frequency is known that in the range of 800 to 1200 Hz in normal adults.[3] In general, it's average is about 900.

Resonant frequency is used to assess the pathology of the adult middle ear system, especially fixation and luxation of the ossicular chain.

The aim of this study is, to create fast and simple screening method to detect ossicular chain pathologies (fixation – luxation, anathomic problems…) in newborns for maturation steps with resonant frequency normalization.

MATERIALS AND METHODS: This study was made in Istanbul University Cerrahpaşa Medical Faculty, in the Department of Hearing and Speech Disorders between April 2013 and March 2015.

Subjects have normal oyologic evidance and normal hearing. Risk factors, sex, birth weight, TEOAE and AABR results were considered. Subject who failed in TEOAE and AABR were excluded.

GSI TympStar V2 Multi Frequency tympanometer was used to evaluate newborns resonant frequency. (250 Hz- 2000 Hz range) The reason of choosing multi frequency tympanometer is to allow to evaluate acoustic immitance's mass and stiffness elements separately. For OAE and screening ABR tests, MADSEN Accuscreen – Newborn Hearing Screening equipment was used.

35 newborn (10 women, 25 men), total 70 ear were testted.

To obtain the most reliable results; subjects was testted while sleeping in room free from enviromental noise.

Subjects have separeted into two groups; 0 - 33 day and 34 - 120 day.

FINDINGS: The study shows that there are no significant difference between both ears resonant frequency.

Resonant frequency average, in range of 0 - 33 day subject group was found ; Right: 280 Hz, Left: 270 Hz.

Resonant frequency average, in range of 34 - 120 day subject group was found ; Right: 386,67 Hz, Left: 380 Hz.

This shows that when the middle ear cavity grows, ossicle's mass effect increases, the resonance frequency increases.

Between subject's maturation (growth) and the middle ear resonance frequency observed positive correlation.

Table. The obtained results are consistent with the literature.

	0 - 33 Day		34 - 120 Day	
	RIGHT EAR	LEFT EAR	RIGHT EAR	LEFT EAR
AVERAGE	280	270	386,67	380
MINIMUM	250	250	300	250
MAXIMUM	400	300	650	650
NUMBER OF EARS	15	15	15	15

RESULTS AND DISCUSSION: In this study, 226 Hz probe tone immitancemetric evaluation on newborns's results whose middle ear resonance frequency is 250 Hz is double peaked curve. The reason for this is 226 Hz probe tone is very closed to resonant frequency (250 Hz).

Therefore, it was observed that 226 Hz probe tone is not very suitable for evaluating newborns middle ear pathologies.

HEARING THRESHOLDS IN CONVENTIONAL AND EXTENDED HIGH FREQUENCIES AUDIOMETRY IN MEDICAL STUDENTS IN RELATION TO THEIR SELF-REPORTED MUSIC-LISTENING HABITS

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PURPOSE: Young persons are often subjected to harmful noise exposure caused by listening to loud music. Extended high frequencies audiometry (EHFA) is considered as more useful in assessment of early hearing loss than conventional pure-tone audiometry (CA) because higher frequencies are more susceptible to damage than conventional frequency range.

The study was carried out to determine the hearing thresholds in CA and EHFA in young adults in relation to their self-reported music-listening habits.

MATERIALS and METHODS: One hundred medical students without otologic complaints were enrolled into the study. In all subjects, CA, EHFA and tympanometry were performed as well as a self-reported questionnaire about music listening habits especially loudness and frequency of music listening in personal music players (PMP).

RESULTS: In the whole group the highest mean values of air conduction hearing thresholds were observed at 6 kHz. It was found that group who listen music quietly has significantly lower mean air conduction hearing thresholds in CA at some frequencies, especially at 6 kHz, than those who listen mid- loud and loud, but there was no such differences in EHFA. There were also no significant differences in CA and EHFA mean values of air conduction hearing thresholds between groups by frequency of music listening in PMP.

CONCLUSION: In medical students, the significant differences were found in hearing thresholds in conventional audiometry, but not in extended high frequency audiometry, according to their self-reported music-listening habits. These differences were related to loudness, but not to frequency, of music listening in PMP.

KEYWORDS: Extended high frequency audiometry, conventional audiometry, music listening, students

DO CHILDREN ALLOCATED TO A VISUAL REINFORCEMENT AUDIOMETRY (VRA) CLINIC RECEIVE VRA?

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The recommended behavioural hearing assessment for children under the age of 2½ is visual reinforcement audiometry (VRA). The Sirona children's audiology service provides specific VRA clinics to which children are triaged based on age alone. Each child seen in an audiology clinic receives outcome codes relating to type of hearing assessment performed. The business analysis team provided a list of children seen in VRA clinics during a six month period in 2014 and also the outcome code against each visit. 189 appointments were identified for 178 children. Records for all children were examined; 11 children were seen twice during the study timeframe

Of all 189 VRA appointments attended 116 were recorded as receiving VRA (60%) although in only 93 cases was the result considered reliable. While almost 50% of children do actually receive VRA and produce reliable results only 6% achieve ear specific thresholds and a further 14% produce results affected by an intrinsic factor within the child (such as non conditioning for the task).In some cases it was made clear that sound field VRA was attempted because the referral query was about access to everyday speech rather than a specific concern about hearing. It is not surprising that some children are offered play audiometry as the 2½ year age cut – off is arbitrary and other techniques may be more appropriate as children approach this age.

Recommendations and standards for conducting and recording VRA outcome and clinic operation are suggested

KEYWORDS: Children, visual reinforcement audiometry, insert earphones

DIFFERENT PATTERNS OF SPATIAL RELEASE FROM MASKING IN FIRST AND SECOND LANGUAGE

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Models of non-native speech perception suggest that native- and non-native speakers might give different weights to acoustic and linguistic cues, especially under adverse listening conditions. Here we ask whether the pattern of spatial release from masking differs between native and highly-proficient non-native listeners. To this end, speech perception was tested in 20 native Hebrew speakers and in 24 non-native speakers (L1: Arabic) under three conditions differing in the spatial setting of the target (bi-syllabic Hebrew words) and the masker (4-talker Hebrew babble noise): 1) frontal-masking: target and masker presented from the same (frontal) location; 2) unilateral-making: target presented from a frontal speaker and masker presented from either +45º or -45º; 3) bilateral-masking: target presented from a frontal speaker and masker presented simultaneously from +45º and -45º. Speech perception was evaluated in 5 SNR levels: -4, -6, -8, -10, -12 dB. Results: In both native and non-native speakers, speech perception was more accurate in the unilateral-masking condition than in the frontal-masking condition. However, in contrast to native speakers who performed less accurately in the bilateral-masking condition than in the frontal-masking condition, the perception of non-native listeners actually improved with bilateral-masking. These data suggest that non-native listeners use subtle acoustic cues to a greater extent than native listeners when listening to speech in adverse conditions.

KEYWORDS: Speech perception in noise, non-native speakers, spatial separation

FACTORS FOR GOOD ACOUSTIC ENVIRONMENT IN SCHOOLS AND DAY-CARE CENTERS

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INTRODUCTION: In Norway there is an increasing national attention on noisy environments in schools and day-care centers. For some years our department has carried out projects and research in classroom acoustics and universal design for hearing and speech. Based on this activity we have pursued the topic with the aim of developing a tool for good acoustic environment.

MATERIALS and METHODS: A group of eight experts from Norway and Sweden was invited to collect as much information as possible in form of different factors inflicting on the acoustic environment, all from the smallest whatsit up to projecting and planning issues. Two representatives from a Swedish day-care center was also included. This center had undertaken a total makeover in acoustics and attitude, a change from being an ugly duckling to becoming a white

swan. All these representatives gathered for a two-day consensus conference with the aim of producing a systematic tool for obtaining a good acoustic environment, both for planning and for rehabilitation purposes.

RESULTS: A systematic tool for three domains (building, room and good practice) was the outcome of the conference. The tool will be presented, and an ongoing follow up study of linking the different factors to internet resources will be mentioned. Unfortunately these resources mainly are in the Scandinavian languages, but the tool is free to use, and other national resources may be developed.

KEYWORDS: Classroom acoustic, day-care center noise, classroom noise, noise rehabilitation, acoustic solution, acoustic tool

FOR THE BEGINNING OF THE SCIENTIFIC RESEARCHES IN BULGARIAN AUDIOLOGY AND ITS DEVELOPMENTS UNTIL 1986

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INTRODUCTION: Audiology in Bulgaria is not independent clinical discipline. It is legally arranged as clinical practice and it is highly specialized activity in the frame of otorhinolaryngoloy. It is part of ENT department as area of scientific knowledge in medicine.

AIM: The aim of the article is to analyze the created during the ears specific scientific and research product and to determine the author contribution of leaders in Bulgarian audiologists.

TASKS: 1. Investigation of the institutional rise and development of audiology in Bulgaria as department in the frame of otorhinolaryngoloy; 2. To determinate structure, frame and subject content of the scientific and research program; 3. To specify and to personalize the Bulgarian contribution.

MATERIALS and METHODS: For the purpose of the article were used methods of empirical level for documents, method for division into periods, systematical, institutional, scientifically-metric, historical and group of logical methods – on theoretical level

DISCUSSION and CONCLUSIONS: It is scientific and research program, which includes the subject of audiology and it represent a wide and instructive thematic field gathered the efforts and personal contribution of several generations Bulgarian audiologists.

KEYWORDS: Scientific and research program, audiology, institutional development

BILATERAL SEQUENTIAL COCHLEAR IMPLANTATION IN AN ADULT WITH BILATERAL BLINDNESS

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Cochlear Implants (CI) are hearing protheses for individuals with severe to profound hearing loss with intact cochleas and functioning eight nerves. Today, cochlear implants are often applied bilaterally in the world. In Turkey one of the indications for bilateral implantation is bilateral blindness. Saed et. al (1998) suggest that implantation in deaf-blind are very usefull. As a matter of fact, cochlear implantation in hearing impaired people with visual problems and blindness have been investigated in different studies and it has been found that implant receivers responses were good to the application (Saed et.al, 1998). More over cochlear implantation is found to be able to play an important role in rehabilitation of people with severe visual and hearing impairment (El-Kashlan et al., 2001). According to Hindering et. al (1994) cochlear implant users with Usher's syndrome (auditory and visual impairment) were not found to be significantly different from visually intact cochlear implant users on suprasegmental and segmental speech perception tests and on a connected discourse tracking tasks, significant advantages in hearing and social life has been reported by the cochlear implant users. In this current study an adult with blindness (confirmed by Opthalmologist) and progressive hearing loss, who have received sequential bilateral cochlear implants is presented. The auditory abilities with single, and bilateral implants, changes in life quality after implantation is discussed. There was a clear imporvement in quality of life, and auditory abilities.

KEYWORDS: Blindness, bilateral cochlear implants, improvements

COCHLEAR IMPLANTATION AFTER FAILED STAPES SURGERY IN FAR ADVANCED OTOSCLEROSIS

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Otosclerosis is a ear pathology due to abormal growth of otospongiotic bone in middle or inner ear, which in turn leads to fixation of stapes, formation of fenestral otosclerotic plaques and cochlear otosclerosis in retrofenestral involvement (Flook et. al., 2011). According to House and Sheehy in 1961 (cited in Calmes et.al., 2007) far advanced otosclerosis refers to long-term otosclerosis described by air conduction hearing tresholds of 85 dB or worse with no bone conduction tresholds (related to equipment limitations). Treatment options for otosclerosis are ear surgery, hearig aids and cochlear implantation, the results of which have been compared in different studies (Ruckestein et. al. 2001, Berrettini et. al. 2004, and Camels et. al. 2007). Proposed sequence of treatment for far advanced otosclerosis is usually application of stapedetomy at first and later cochlear implantation in case of unsuccesfull stapedetomy.

This current study describes 4 cases, who have been applied with otosclerosis surgery before cochlear implantation. One of the cases had improved tresholds, but he was not satisfied with hearing aid use; the other 3 patients had no improvement; all 4 patients were

applied with multi-channel cochlear implants. All patients had improvements in auditory abilities, one of the patients started to communicate on phone at 6 months; quality of life was enhanced for all of them. In one patient facial stimulation was observed, solved by changing the pulse width.

KEYWORDS: Otosclerosis, cochlear implantation, failed stapes surgery

SPEECH PROCESSOR FITTING USING NUCLEUS FITTING SOFTWARE (NFS)

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AIM: The Nucleus Fitting Software (NFS) is a new, simple programming system by Cochlear Ltd. that is suitable to create NRT based-MAPs for cochlear implant recipients. The aim of this study was to compare the MAPs and patients' performance using the new NFS and the traditional Custom Sound systems, respectively.

MATERIALS and METHODS: A prospective comparison study was conducted with 23 patients fitted with the standard Custom Sound and the new NFS softwares. We performed three types of fitting sessions. We made a MAP based on subjective hearing scale, a MAP based on NRT and a MAP using NFS. Three months after the fitting procedure, the auditory performance and the patients' preference were analysed.

RESULTS: Our results showed that the fitting period was significantly shorter using the NFS system than using Custom Sound software. In terms of measuring hearing threshold and speech understanding, there was no significant differences between the selected groups. Patients' preferences showed big variety but some of the patients preferred the MAP created with NFS software.

CONCLUSION: The NFS system is an easily applied fitting software that requires a short time for MAP creation. Technicians and speech therapists with less experience can make usable MAPs for cochlear implant users.

KEYWORDS: Cochlear implant, fitting, NFS

BENEFITS IN SPEECH PERCEPTION WITH RONDO SINGLE-UNIT PROCESSOR

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OBJECTIVE: The aim of this study was to assess the benefits after the upgrade from TEMPO+ and OPUS I to RONDO single-unit processor.

MATERIALS and METHODS: All our participants were prelingually hearing impaired children, implanted before 5 years of age and used MED-EL cochlear implants. We analyzed the results of speech recognition tests in quiet and in noise before and after the upgrade.

RESULTS: The mean score for open field audiometry was 30 dB in both groups. The mean score for polysyllables in quiet at 60 dB was 71.9% in TEMPO+ and 58.6% in OPUS I group (p=0. 148) and increased in both groups (up to 74.7% for TEMPO and 61.9% for OPUS I group on the same day after switch-on, and 80.2% for first and 65.9% for second group six weeks later). There was no significance in the dynamics of this improvement between groups (Mann-Whithey U test p=0. 943). Speech recognition in noise was significantly better in TEMPO+ (68.7%) group first day after RONDO switch-on in comparison with OPUS I (46.7%) (p=0. 44). In the second measurement after six weeks this improvement was significantly better in both groups (TEMPO + from 63% to 84% and OPUS I from 33% to 67%) (p= 0.008 and p=0. 016)

CONCLUSION: The speech understanding in quiet and noise improved with RONDO Single-Unit Processor in experienced cochlear implant users.

RECOMMENDATIONS: The upgrade from TEMPO+ and OPUS I processors to RONDO is easily acceptable and highly beneficial for both groups of patients

KEYWORDS: Cochlear implant, children, upgrade, processor

ACQUISITION OF COMPLEX GRAMMATICAL CATEGORIES IN COCHLEAR IMPLANTED CHILDREN

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Speech and language development in congenitally deaf children is severely impaired despite early intervention through cochlear implantation and postoperative rehabilitation. Beside semantic and lexical contents, the most difficult part is learning of grammar and it's finest details.

Objective of the study was to assess the level of acquisition of complex grammatical categories in children with profound hearing loss who were enrolled in rehabilitation following cochlear implantation.

A group of 21 congenitally deaf children with unilateral cochlear implant was assessed by the use of Serbian version of Test of Reception of Grammar (TROG, Bishop, 1989; Andjelkovic et al, 2007). The test is language specific and therefor adapted for Serbian grammar. Age range of the children in the study was 4 to 12 years and hearing age range was 1 to 8 years. TROG test consisted of 88 items using grammatical contrasts with increasing complexity. Testing time was 20 minutes. The results were subject to quantitative and qualitative analysis. Results were compared to a normative data for 335 normal hearing children of respective age.

The results have shown that children with cochlear implants have expressed fair level of acquisition of complex grammatical catego-

ries after a few years of speech and hearing rehabilitation, but their achievement was still inferior to their hearing peers.

Intensity and duration of postoperative rehabilitation has shown the greatest impact on development of grammar, whereas the age at implantation did not affect the results that much.

KEYWORDS: Children, deafness, cochlear implant, grammar

THE IMPACT ON QUALITY OF LIFE OF MINI MICROPHONE USE IN EXPERIENCED COCHLEAR IMPLANT RECIPIENTS: PROSPECTIVE CLINICAL STUDY

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OBJECTIVE: To assess the subjective listening benefit with the Wireless Mini Microphone in classroom situations, plus effect of short term usage on quality of life in experienced cochlear implant recipients.

MATERIALS and METHODS: Ten 7-14 year old experienced cochlear implant recipients were evaluated with the LIFE-UK IHP questionnaire before and after four weeks of use with the Mini Microphone, used in daily activities especially at school. Data logs from recipients were also evaluated for quantification of the use time. Results were analysed for mean change from the baseline questionnaire rating after four weeks of Mini Microphone use.

RESULTS: Quality of life scores improved after receiving the Mini Microphone and with four weeks of experience.

CONCLUSION: The Wireless Mini Microphone is a desirable device for cochlear implant recipients to improve quality of life.

KEYWORDS: Cochlear implant, quality of life, mini microphone, data logging

HEARING INVENTORY WITH THE PHONE CLIP IN EXPERIENCED ADULT COCHLEAR IMPLANT RECIPIENTS AT WORK AND DURING DAILY LIFE

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INTRODUCTION: A cochlear implant is an indispensable option for patients with moderately severe to profound hearing loss. Still a common problem for cochlear implants users is diffuculty in understanding speech in noisy acoustic environments and speaking on the phone. The Cochlear Wireless Phone Clip provides access wirelessly with bluetooth devices and thus the sound from audio sources reaches directly the cochlear implant system. The aim of this study was to evaluate the effect of the use of the Phone Clip on the patient's quality of life.

MATERIALS and METHODS: The study included 20 patients who had at least three months experience with the Nucleus 6 cochlear implant system. The Custom Sound 4.2 software was used for the cochlear implant programming. Patients were evaluated before using the phone clip and then again after 6 weeks using the Phone Clip, via administration of the International Outcome Inventory for Hearing Aids (IOI-HA), the Speech Spatial Qualities (SSQ) questionnaire (SSQ), a telephone questionnaire and a daily use scale. Obtained results were statistically analysed.

RESULTS: The findings showed an increase in quality of life for the patients when the Phone Clip was used.

RECOMMENDATION: Satisfaction was also noted to be higher after using the Phone Clip with the patient's cochlear implant system.

BIRTH BY CESAREAN AND NORMAL DELIVERY ON NEWBORN HEARING SCREENING TEST: A PRELIMINARY STUDY

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OBJECTIVE: According to World Health Statistics 2014, cesarean delivery rate has increased up to %16 in the world and this ratio varies from country to country. Recently, cesarean delivery rate has been %50 in Turkey. Most studies indicated that infants born by cesarean delivery faced to some problems especially immunity. This study was designed to investigate the influence of cesarean delivery on the newborn hearing screening test results in Turkey.

MATERIALS and METHODS: The study conducted from June2014 to March 2015 in newborn hearing screeining center, İstanbul University, Cerrahpaşa Medical Faculty. In this study, only born in our hospital, 336 infants born by cesarean delivery (Mean age ± SD: 1.15 ±0,47days) and 157 infants born by normal delivery (Mean age ± SD: 1.05±0.5 days) were included. All of the newborns with no risk factors were screened by otoacoustic emission test. The test was performed before discharge within 48 hours. Infants failed first otoacoustic emission test were screened again after 10 days. Data were calculated by SPSS 21, chi-square Fisher's exact test.

RESULTS: There was statistically significant difference between infants born by cesarean and normal delivery in 48 hours ($p<0.05$). Failed rate with cesarean delivery was found higher than normal delivery on first otoacoustic emission test (%41). When we look at the first and second otoacoustic test data, there was no statistically significant difference in both delivery ($p>0.05$).

CONCLUSION: According to these findings, effects of cesarean delivery were difference on newborn hearing screening test in 48 hours.

We consider first otoacoustic emission test after cesarean delivery should be performed after 48 hours of life. So we can avoid parental anxiety and unnecessary expenses.

KEYWORDS: Newborn hearing screening, cesarean delivery, normal delivery, otoacoustic emissions

TONE BURST EVOKED OTOACOUSTIC EMISSIONS IN NEWBORNS

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Click evoked otoacoustic emissions in newborns are known to be good indicators of hearing function when used in the frequency range 1.5–4 kHz. The present study investigates the usefulness of responses in the lower frequency range of 0.5–1 kHz evoked by 0.5 kHz tone bursts. Otoacoustic emissions (OAEs) were recorded from the ears of newborns. In each ear two OAE measurements were made: first with a standard click stimulus at 80 dB pSPL (CEOAEs) and a second using a 0.5 kHz tone burst at 80 dB pSPL (TBOAEs). Tympanometry was also conducted. Half-octave-band values of OAE signal to noise ratios (SNRs) and response levels were used to assess statistical differences. For the 0.5 kHz tone bursts the peak response occurred at 0.7–1 kHz. Generally, CEOAE SNRs were about 10 dB in the 1–4 kHz range, while SNRs for 0.5 kHz TBOAEs were about 10 dB at 0.7–1 kHz. 0.5 kHz TBOAEs could be measured in newborns as effectively as CEOAEs. They can provide additional information about the 0.7–1 kHz frequency range, a range over which CEOAEs do not usually contain responses above the noise floor.

KEYWORDS: Otoacoustic emissions, CEOAE, TBOAE, response level, signal to noise ratio

THE DIAGNOSTIC ACCURACY OF SCHOOL HEARING SCREENING TESTS AND COST-EFFECTIVENESS OF SCHOOL ENTRY HEARING SCREENING PROGRAMMES

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OBJECTIVE: The two overarching aims of this project were to evaluate the diagnostic accuracy of hearing screening tests and to assess the cost-effectiveness of screening for hearing impairment at school entry in the UK.

MATERIALS and METHODS: We undertook a diagnostic accuracy study comparing the pure-tone sweep (PTS) method with the Siemens Hearcheck (HC) device using a two-gate (case control) design; a cohort study to compare referrals to paediatric audiology services for children aged 3-6 years between a site with and a site without a School Entry Screen (SES); a questionnaire survey of parents whose child had been referred by the SES; an observational study of the use of PTS and HC in schools; and a cost-effectiveness evaluation of the SES programme.

RESULTS: In an analysis of he accuracy, including data from individual ears, PTS had a higher sensitivity than HC but HC had a higher specificity using pure tone audiometry as a reference standard. In an analysis including data from individual children, the SES is unlikely to be cost-effective but this depends critically on the referral rates for diagnostic evaluation.

CONCLUSION: It is important to note that a system including SES also generates referrals from other sources e.g. General Practitioners, parents etc. The relative value of sensitivity and specificity of screening tests within the programme will contribute to decisions concerning its implementation.

Presented on behalf of the SES research team: Zhivko Zhelev, Clive Pritchard, Claire Benton, Joanne Moody, Sam Errington, Laura Cocking, and Julian Watson

KEYWORDS: School entry hearing screen, diagnostic accuracy, cost-effectiveness

SCHOOL AGE HEARING SCREENING BASED ON SPEECH-IN-NOISE PERCEPTION: LARGE-SCALE APPLICABILITY OF THE DIGIT TRIPLET TEST

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In Flanders, periodic hearing screening of school children is mandatory. Up to now, pure tone audiometry was routinely used for this purpose. However, the lack of optimal testing conditions, uniform test protocols and referral criteria prompt the need for alternative screening methodologies. Currently, the applicability of the Digit Triplet Test – a quick, automated speech-in-noise adaptive self-test – for large-scale hearing screening of 10 and 14 year old children is being evaluated.

Pupils with an abnormal test result (based on initially set age-specific cut-off speech reception thresholds) are referred to an ENT specialist for expertise pure tone testing. The aim is to fine-tune the cut-off values for the purpose of a balanced referral and investigate test reliability.

After 5 months, more than 6000 children have already been screened. According to current cut-offs, 5.5% (10y) and 5.1% (14y) were referred. Intrasubject measurement error was found to be very low in both groups (0.6 dB). Median SRTs were -9.9 dB SNR for the younger and -10.6 for the older children. Also, test duration shortens with age.

ENT expertise audiograms from referrals will allow us to set uniform and accurate cut-off values in order to obtain the highest possible sensitivity to detect (minimal) hearing impairment. Due to the low measurement error, accurate follow-up is possible. Furthermore, the availability of an effective registration system for data storage will enable to link school age hearing screening results with data from previous screenings and provide insights into the prevalence of acquired hearing loss in school children.

KEYWORDS: Referral criteria, screening methodology, prevention, acquired hearing loss, children

AGE-RELATED HEARING LOSS AND COGNITIVE DECLINE: THE EFFECT OF HEARING AIDS

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OBJECTIVE OF THE STUDY: The aim of this study was to evaluate the efficacy of hearing aid (HA) therapy on the cognitive capabilities of age-related hearing impaired subjects using the purely visual Raven Test as well as the specific listening comprehension Token Test.

DESIGN: Prospective longitudinal study

MATERIALS and METHODS: 189 subjects (65 - 85 years) affected by age-related hearing loss and with a Minimental State Examination > 24/30 were recruited, Subjects who had previously been referred for vertigo or aequilibrium disorders or for hearing loss/otologic problems were excluded. Pure-tone threshold assessment, speech audiometry with bisyllabic words and speech audiometry with verbal task and motor response were performed together with the Token and Raven Tests. Sixty subjects were fitted with a HA and re-evaluated after four months. A parametric univariate t-test was performed and values of $p \leq 0.05$ were considered statistically significant.

RESULTS: The results of speech audiometry with bisyllabic words and speech audiometry with verbal task and motor response were better in terms of both intensities and percentage of correct answers ($p<0.0001$). The Token Test scores improved significantly regardless of the aided and unaided pure-tone threshold average ($p < 0.001$). The most interesting and unexpected result is to note that the Raven Test results, too, showed a significative improvement ($p < 0.05$)

CONCLUSION: HA fitting proved to generate an improvement in short-term memory connected both with the capability of understanding repetitive commands (Token Test) and, more unexpectedly, with an improvement in fluid intelligence in a non verbal cognitive test (Raven Test).

COST-EFFECTIVE CHILDHOOD HEARING AND VISION SCREENING IN EU-MEMBER STATES

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Hearing and vision screening programs in Europe differ regarding screening tests, screening age, frequency of testing, coverage, professions involved in the screening, referral and funding. Health equity demands the robust assessment of these programs and subsequent reallocation of resources. The research question of the EUS€REEN study is whether vision and hearing screening programs can be optimized through cost-effectiveness modelling, taking differences between health-care systems and political, economic and societal contexts into account.

During the preparation of a grant application, an inventory of EU screening programmes was made in a pilot survey. We compiled 3 questionnaires on vision, hearing and public-health screening. The questionnaires were sent to ophthalmologists, orthoptists, otolaryngologists and audiologists involved in pediatric screening in all EU full-member, candidate and associate states.

Substantial differences were found between hearing screening programs in the EU. As first hearing screening test, otoacoustic emission (OAE) is used most in healthy neonates and auditory brainstem response (ABR) in premature newborns. The majority of testing procedures are staged, but the number of negative tests before referral varies from two to four. Additional preschool screening is performed in about half of the countries. Differences between EU vision screening programs were even larger.

We conclude that in spite of the introduction of neonatal hearing screening, remarkable differences are found in the implementation of hearing screening between European countries. In the projected EUS€REEN study, the aim is to design and populate a decision-analytic modelling framework that measures the opportunity cost of hearing and vision screening programs within EU-countries.

KEYWORDS: Hearing screening, pre-school screening, neonatal screening, cost-effectiveness, ABR, OAE

WHAT CAN WE LEARN FROM ESTABLISHED NEWBORN HEARING SCREENING PROGRAMS IN THE EUROPEAN AREA

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Several countries of the European Area have not fully implemented newborn hearing screening and early intervention programs. Even in countries where nationwide programs have been successfully in place for years, great inter- and intra-country variations are observed, both in protocols and outcomes. On the other hand, a huge amount of high quality data are stored for literally millions of screened babies and thousands of children who have been included into habilitation programs, in a number of regions/countries in the European area. This can constitute an extremely valuable bases to evaluate models, organizational protocols, for screening, diagnosis and intervention strategies.

On this ground, a consortium of groups from the European Area internationally recognized as leaders in their own field has recently submitted to the EC (in a Call conceived to re-evaluate any kind of

screening programs) an ambitious project aimed to systematically re-evaluate well established programs across Europe, including countries with different health systems and varying levels of access to screening protocols and intervention strategies. Despite the good results obtained at the completion of the evaluation process, the project was not funded, for a number of motivations not related to its scientific quality.

The present communication shall summarize the original project (and the roles of the partners who contributed to the development of the proposal itself) and illustrate how such retrospective studies may be a powerful tool to provide a number of outcome measures which only nowadays can be obtained, when huge numbers of treated children are available for the analysis.

KEYWORDS: Screening programs, re-evaluation of screening programs, outcome measures of screening and intervention programs

LISTENING EFFORT IN SCHOOL-AGE CHILDREN

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In recent years, more and more attention is being given to understanding the cognitive aspects of speech comprehension in hearing-impaired individuals. This is partly motivated by reports of the mental fatigue experienced by hard-of-hearing persons despite achieving high speech intelligibility scores with their hearing devices.

According to the framework of "levels of processing", processing depth increases as a given verbal task moves from phonological recognition to semantic extraction. Deeper levels of processing require more cognitive resources and are therefore more susceptible to the effects of degraded signals or competing tasks, that is, more "listening effort". Among the many proposed measurement methods, behavioural paradigms excel in being more clinically feasible than electrophysiological techniques while not relying on subjective reports from the patients themselves.

The goal of the present study is to develop a sensitive and reliable dual-task assessment of listening effort for children aged 8 to 12. The test takes into account interests, cognitive abilities, and semantic knowledge of this particular population. In addition to repeating words, a child will be instructed to react quickly to one of the following three conditions: seeing an even number (a visual categorization task), hearing an "animal" word (an auditory categorization task), or hearing a "dangerous" word (a more elaborate auditory categorization task). An increase in reaction time will indicate an increase in cognitive demands imposed by the experimental procedures. After pilot testing, this behavioural paradigm will be validated in normal-hearing school-age children. The data from the study will be presented at the conference.

KEYWORDS: Listening effort, depth of processing, children, fatigue, dual-task paradigm

TEMPORAL PROCESSING DEFICIT ASSOCIATED WITH SPECIFIC LANGUAGE IMPAIRMENT: WHAT IS THE ROLE OF IMMEDIATE MEMORY CAPACITY?

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A number of authors have suggested that a perceptual auditory disorder involving temporal processing is the primary cause of Specific Language Impairment (SLI). The aim of this study was to determine possible differences in performance for a temporal processing task between children with SLI and children with typical language development, controlling for group differences in immediate memory capacity. Twenty participants with SLI aged 6 years were selected, along with 20 age- and gender-matched children with typical language development. The Adaptive Test of Temporal Resolution (ATTR) was used to evaluate temporal resolution ability (an aspect of temporal processing). The digit span forward and digit span backward, both as part of a subtest of the Wechsler Intelligence Scale for Children, were used to evaluate short term memory and working memory, respectively. Statistically significant correlations between ATTR scores and digit span (forward and backward) were found for the group of children with SLI but not for children without SLI. Two models of analysis of covariance (ANCOVA) were created to determine a possible association between SLI and ATTR scores. One model controlling for the confounding of short term memory (digit span forward) and the other one controlling for working memory (digit span backward). Both models showed that children with SLI performed significantly worse than children with typical language development on the temporal resolution task. It is concluded that children with SLI as a group present temporal processing difficulties that cannot be attributed solely to the deficit on immediate memory associated with SLI.

KEYWORDS: Temporal processing, specific language impairment, short term memory, working memory

PRELIMINARY NORMATIVE DATA FOR THE COMPUTERIZED CENTRAL AUDITORY PROCESSING DISORDER TESTS IN TURKISH ADULTS

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OBJECTIVE: The aim of this study was to establish preliminary normative data of Computerized Frequency Patterns Test (CFPT) and Computerized Duration Patterns Test (CDPT) for a healthy Turkish adults.

MATERIALS and METHODS: This study was conducted at Hacettepe University, in Otorhinolarnygology Department, Audiology and Speech Pathology Unit. A total of 35 healthy subjects (15 male and 20 female) were recruited. Age varied between 19 and 50 (mean age: 32.40±9.31 years). CFPT and CDPT were administered to all subjects. CFPT and CDPT scores were analyzed. Also reaction time values of CFPT and CDPT were analyzed.

RESULTS: Mean percentage CFPT right ear score was 85.48±13.94 while left ear score was 88.77±11.0. Mean CDPT score was 80.97±14.65 for right ears and was 79.28±15.70 for left ears. Mean reaction time right ear score for CFPT was 3.20±1.65 while left ear score was 3.30±1.66 and mean reaction time score of CDPT for right and left ear were 2.42±1.02, 2.67±1.18, respectively.

CONCLUSION: Preliminary normative data were obtained in the present study for CFPT and CDPT. These results can be useful as a reference for evaluation of disorders of central auditory processing.

KEYWORDS: Frequency pattern, duration pattern, reaction time, normative data.

AUDITORY TEMPORAL PROCESSING DEFICITS IN PATIENTS WITH APHASIA

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OBJECTIVE: Aphasia is characterized by impaired comprehension and production of language resulting from a stroke affecting the left hemisphere of the brain. Auditory processing encompasses both the comprehension of a spoken message and its retention in memory. Severe auditory comprehension deficits associated with aphasia can impact all aspects of a person's life. There is limited data regarding how auditory temporal processing deficits impact detection of a communication breakdown. Therefore, the purpose of this study was to investigate detection of auditory comprehension breakdowns in patients with aphasia.

MATERIALS and METHODS: Participants included 10 adults with chronic aphasia. All participants had aphasia due to left hemisphere stroke, were at least 1 year post onset, were right-handed, native speakers of Turkish and demonstrated hearing and vision adequate to perform the experimental tasks. Each participant completed the informed consent form, and the biographical survey prior to administration of the T- CRTT, Mini Mental, and Acoustic Chang Complex (ACC) tests. ACC is an auditory cortical potential which can be defined as the response of of auditory system to changes in stimuli. T-CRTT was designed to quantify auditory processing abilities and give the clinician information about the individual's auditory attention, auditory memory, and temporal processing abilities.

RESULTS: The results of patients demonstrate that auditory deficits can be a sequel to aphasia and that these deficits are often subtle and may not be detected unless auditory processing testing is conducted.

KEYWORDS: Aphasia, auditory processing, T-CRTT, Acoustic Chang Complex

EVALUATION OF AUDITORY PROCESSING SKILLS IN PATIENTS WITH HEAD INJURY

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OBJECTIVE: Head injury may cause damage to the central nervous system; therefore, the central auditory nervous system must be evaluated in this individuals after head injury. In this study, it is planned to evaluation of auditory processing and auditory perception abilities with head injured patients by standardized tests.

MATERIALS and METHODS: Individuals between 18-55 years of age, at least 6 months after head trauma history, with no additional neurological problems and history of psychologic illness were included in this study. Five head injury individuals with normal hearing evaluated and they have undergone the following tests: Mini Mental State test (score of 20 and above), pure tone thresholds lower than 25dB between 0.5, 1, 2, 4 kHz, Computerized Frequency Pattern Test (CFPT) and Computerized Duration Pattern Test (CDPT).

RESULTS: Five individuals mean aged between 31.20±11.92 were evuluated. The average of Computerized Frequency Pattern test (CFPT) score for the right ear was 52 ±24.16, for the left ear was 52±26.91 and the reaction time for the right ear was 2.10±.51 and for the left ear was 52±26.91. The average of Computerized Duration pattern test (CDPT) score for the right ear was 32.20±18.53, for the left ear was 51,40±32.38 and the reaction time for the right ear was 2.06± .37, for the left ear was 2.47± 1.70.

CONCLUSION: It is important to assess whether any impairment of auditory processing for planning of rehabilitation programs. These data we obtained from the five patients can provide useful information about auditory processing abilities of patients with head injury. This study will be obtained from patients with neurological treatment program data could gain a new perspective.

KEYWORDS: TBI, auditory processing, duration pattern, frequency pattern

THE SCAN-C (CHILDREN) IN TESTING FOR AUDITORY PROCESSING DISORDER IN A SAMPLE OF TURKISH CHILDREN

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Auditory Processing Disorder (APD) is an umbrella term used to describe various difficulties in the ability to discriminate, identify, or comprehend auditory stimuli, particularly when the auditory signal is in any way degraded, in spite of normal peripheral hearing thresholds and cognitive abilities.The SCAN is a battery of tasks used for the screening and diagnosis of auditory processing disorder.

OBJECTIVE: Objective of the study was to make an adaptation of Turkish SCAN diagnostic test at Turkish children with auditory processing disorders.

MATERIALS and METHODS: The SCAN-C ((FW) was composed of filtered words, (AFG) auditory figure-ground, (CW) competing words, (CS) competing sentences) subtests. Each of these tests were administered and scored. Each test item was preceded by the words "Say the word". At the start of testing, the presentation volume was adjusted to a comfortable level for each participant (time 20-30 minutes). All subtests were recorded on the provided audio CD. For normative data, the study included 500 healthy children (aged between 5 years, 0 months, to 11 years, 11 months).

RESULTS: Normative test results were presented. Scores obtained by the tests were evaluated as percent scores for clinical usage.

CONCLUSION: Implications for use of the Turkish SCAN-C tests were discussed.

KEYWORDS: Auditory processing disorder, SCAN-C, Turkish

ASSESMENT OF TEMPORAL PROCESSING FUNCTIONS OF COCHEAR IMPLANTED CHILDREN

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Temporal processing refers to processing of sound in time and plays a significant role on speech perception. Cochlear implant (CI) is a significant approach to develop the speech perception in prelingual deaf children. The age of implantation is one of the most important factors affecting auditory performance.

In our study,the 9-10 year old children with CI whose ages for implantation were 1-2 (n:10), 2-3 (n:10) and 3-4 were included. We used Frequency Pattern Test (FPT), Duration Pattern Test (DPT). These test were compared within the CI groups and normal hearing control group (n=10).

In results, while a significant difference was found between control group and 3-4 age of implantation group in temporal ordering ability, no significant difference was found between the groups of implanted before 3 ages. Despite the fact that there was no significant difference within CI groups in the temporal processing ability, they had better performance as the implantation age decreases. Early implanted children are able to reorganize the degeneration of auditory pathways which are caused by auditory deprivation and have similar performance with their normal hearing peers. The fact that the children who were implanted after the age of 3 have worse performance than children with normal hearing peers was associated with the long duration of the auditory deprivation, which was thought to have negatively affected the temporal processing ability. It is considered that the evaluation of the temporal processing in the individuals with CI will contribute to the determination of the nature of disorder and give guidance to auditory rehabilitation.

KEYWORDS: Temporal processing, cochlear implantation, auditory maturation

COCHLEAR REIMPLANTATION: AUDIOLOGICAL OUTCOMES AND ASSESSMENT OF QUALITY OF LIFE

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The aim of the present study was to investigate audiological outcomes and patients' quality of life after the explantation and reimplantation procedures. The retrospective study of 606 patients was carried out in Tomsk Branch of the FSBE of the "Research Center of Otorhinolaryngology of the FMBA", Tomsk, Russia. All patients underwent cochlear implantation between 1 January 2006 and 31 December 2014. Thirty cases required reimplantations due to several causes. All patients underwent audiological evaluation, device integrity testing and high-resolution CTscans of the temporal bones before the revision surgery. Speech perception performance and quality of life assessment were measured by using several closed and open set tests, as well as questionnaires: 36 Item Short Form Survey (SF-36), Cochlear Implant Function Index (CIFI) and Infants-Toddlers Meaningful Auditory Integration Scale according to the patient's age, cognitive and linguistic levels. The study was conducted in 2 stages: before the explantation surgery and 3 months after the reimplantation.

Postsurgical audiological outcomes were unchanged or improved in comparison with the basic values in all reimplanted patients. Meanwhile, the quality of life decreased in some domains according to SF-36: role physical, emotional and social functioning. The questionnaire CIFI showed significant decreases in several levels of function in comparison with the basic Findings; assessment of hearing function in social groups and in work environments. Hence, our study showed the great impact of explantation and reimplantation procedures on patients' quality of life that's why it is crucial to improve device technologies.

KEYWORDS: Reimplantation, questionnaire, quality of life

HEARING PRESERVATION COCHLEAR IMPLANTATION WITH COCHLEAR NUCLEUS CI 422 ELECTRODE IN CHILDREN WITH RESIDUAL HEARING

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OBJECTIVE: Low frequencies are crucial for fine time structure information delivery, which is especially important for appropriate language development in children with profound hearing loss. Cochlear implantation aiming preservation of low frequency residual hearing requires special atraumatic approach. 6 steps surgical procedure for partial deafness treatment was designed and applied for this purpose being applicable in adults as well as in children.

MATERIALS and METHODS: 48 children, aged 6-18, with usable low frequency residual hearing underwent cochlear implantation with Nucleus CI422 cochlear implant since 2010 to 2014. Minimal invasive surgical procedure with round window approach was applied in every case. All patients were out on steroids intra-operatively and in early postoperative period. Tonal audiometry was used to assess hearing preoperatively and in each interval of follow up.

RESULTS: Accoring to a new classification of hearing preservation the overall rate for the whole implanted group at activation was 0.76. At 1 year follow up – 0.72, at two years -0.68. 8% of minimal preservation of hearing appeared over follow up period. Speech audiometry tests showed significant improvement in both AAST and SA.

CONCLUSION: 24 contacts electrode, like Nucleus CI 422 is proved to be a good solution for hearing preservation surgery in children, giving possibility for successful preservation of low frequency hearing, and combined electric - acoustic stimulation.

KEYWORDS: Hearing preservation, cochlear implantation, residual hearing

SPEECH INTELLIGIBILITY WITH THE MINI MICROPHONE IN EXPERIENCED COCHLEAR IMPLANT RECIPIENTS

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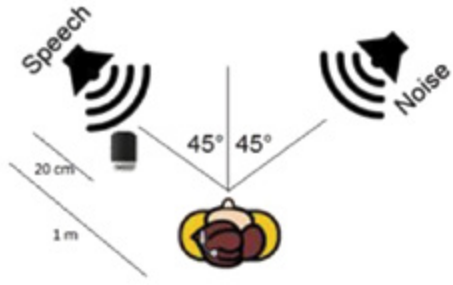
INTRODUCTION: The Cochlear Wireless Mini Microphone is a miniature, wireless remote microphone that transmits the audio signal captured at the microphone directly to the recipient's Nucleus 6 Sound Processor via the proprietary GN Resound digital radio frequency transmission protocol on the 2.4 GHz band. It enhances speech recognition, sound quality and overall listening experience in situations that are known to provide the most difficulty for cochlear implant recipients. Preliminary results from Wolfe, et al., of a paper showed that the Mini Microphone resulted in significantly better speech recognition when compared to performance with the Nucleus 6 alone.

OBJECTIVE: To assess the hearing performance in experienced cochlear implant recipients with and without the Mini Microphone.

PARTICIPANTS-PROCEDURES: 20 unilateral cochlear implant recipients participate in this study all who are fitted with Nucleus 6 sound processors. Duration of cochlear implant use is at least 7 years. The recipients use the Mini Microphone in daily life for 8 weeks duration and every week note their experiences in a diary. Speech recognition in quiet and in noise is then assessed with and without the use of Mini Microphone. Recipients are seated 1 m from loud speakers which are located at +/-45 degree azimuths in a S-45N45 configuration. The Mini Microphone is positioned 20 cm directly below the loudspeaker that is used to present the target signal.Word recognition in noise is evaluated at SNR +5 dB.The IOI-HA and SSQ questionaires are administered pre and post Mini Microphone use to all recipients.Datalogging is noted for all participants.

KEYWORDS: Speech recognition, cochlear implant, Cochlear Wireless Mini Microphone

Test Setup



BIMODAL HEARING AID RETENTION AFTER UNILATERAL COCHLEAR IMPLANTATION

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The goal of this study was to investigate contralateral hearing aid (HA) use after unilateral cochlear implantation (CI) and to identify factors of influence on the occurrence of a unilateral CI recipient becoming a bimodal user. A retrospective cross-sectional chart review was carried out among 77 adult unilateral CI recipients one year after implantation. A bimodal HA retention rate of 64% was observed. Associations with demographics, hearing history, residual hearing, and speech recognition ability were investigated. Better pure-tone thresholds and unaided speech scores in the non-implanted ear, as well as a smaller difference in speech recognition scores between both ears were demonstrated to be significantly associated with HA retention. To identify the CI recipients who were most likely to become bimodal users, a combined model of HA retention was pro-

posed and cut-off points were determined. These results can provide input to clinical guidelines concerning CI candidacy.

KEYWORDS: Bimodal hearing, patient preference, cochlear implant, hearing aid, residual hearing

SPEECH PERCEPTION OF COCHLEAR IMPLANT USERS WITH BIMODAL HEARING

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INTRODUCTION: Over the past decade the number of cochlear implant candidates with substantial residual hearing on the contralateral side increased. Therefore, bimodal hearing becomes more and more important. The aim of this study was to investigate the contribution of the cochlear implant as well as of the hearing aid postoperatively in quiet and in noise and to determine the bimodal gain.

MATERIALS and METHODS: 86 adult CI users implanted at least 3 months ago using a hearing aid on the contralateral side have been investigated. Postoperative speech perception in quiet as well as in noise has been measured using Göttingen sentences (65 dB). Speech understanding in noise was determined using an adaptive measurement method. Speech perception has been tested for the cochlear implant, the hearing aid and bilateral.

RESULTS: A significantly higher bimodal speech understanding (89%±12%) in comparison to each of the monaural measurements (cochlear implant (75%±20%); hearing aid (69%±25%)) respectively has been detected in quiet. In noise, increased speech understanding reflected by an improved speech-to-noise ratio was also present for the bimodal hearing situation (bimodal hearing (2.9dB±2.4dB); cochlear implant (7.6dB±5.5dB); hearing aid (6.6dB±4.6dB)). For our patient cohort, there was no significant difference between cochlear implant and hearing aid concerning speech understanding results in quiet and in noise.

CONCLUSION: The results of this study show that CI listeners benefit from the hearing aid as well as from the cochlear implant in quiet situations and in noise.

KEYWORDS Bimodal gain, speech understanding, noise

SPEECH INTELLIGIBILITY WITH THE PHONE CLIP IN EXPERIENCED COCHLEAR IMPLANT RECIPIENTS

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Cochlear has a a Bluetooth® audio streaming accessory called Cochlear Phone Clip+ that may be used with mobile smart telephones or other Bluetooth-enabled personal electronics This wireless accessory is available for Nucleus 6 speech processors.When the speech processor is paired with the Phone Clip+, tthe phone clip received the auditory input directly from the telephone and delivers it to the speech processor. The use of Cochlear Phone Clip+ aims to enhance speech recognition during telephone use The aim of the study is to evaluate the effect of Phone Clip + use in speech intelligibility over the telephone 20 cochlear implant recipients took part in the study. The age range was 17 to 65 years. All patients have at least one year experience of cochear implant use.The speech intelligibilty over the telephone was assessed with Turkish monosyllabic words which were read by an experienced audiologist via telephone at normal conversational level (60-65 dBA). Monosyllabic words were tested in four conditions in quiet with Nucleus 6 alone and Nucleus 6 + Phone Clip +; in noise Nucleus 6 alone and Nucleus 6+ Phone Clip +. Monosyllabic words recognition scores obtained in four condition will be presented.The Phone clip+ enhance speech understanding over the telephone in noisy conditions.

KEYWORDS: Phone clip, cochlear implant, speech intelligibility

ADAPTIVE REMOTE MICROPHONE TECHNOLOGY: ACCELEROMETER STEERED AUTOMATIC MICROPHONE MODE AND MULTIPLE MICROPHONE NETWORK PERFORMANCE IN NOISE

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Speech understanding challenges in noise are best addressed with advanced microphone technology.

Latest developments in digital adaptive remote microphone technology include an automatic microphone mode, which allows for context dependent signal processing. The context is given by the acoustic scene and the orientation with respect to gravity of the wireless microphone, which is determined by an in-built accelerometer. Speech in noise testing with 11 hearing aid users equipped with adaptive digital remote microphone technology was carried out for three different orientations of the wireless microphone. The results indicate that no manually selected microphone mode gives a better performance than the automatic mode for all microphone orientations.

Another recent development is the possibility of creating a network of multiple microphones, which can be used in noise when listening to multiple talkers, a situation which can happen for instance in a restaurant. Speech in noise measurements were carried out with 12 adult CI recipients equipped with digital adaptive remote microphone technology. Speech was presented at random from one of three loudspeakers, to mimic a conversation in a noisy restaurant. There was a statistically significant improvement in SRT in the multiple wireless microphone condition of 14.8 dB over the CI alone condition.

KEYWORDS: Remote microphone, Roger, automatic microphone mode, speech in noise, SRT

EFFECTS OF CAFFEINE ON SPEECH IN NOISE SCORES

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OBJECTIVE: The process of white band noise in speech signals can be exploited by the masking properties of the human hearing system. Caffeine that is a chemical agent, which sitimulates nervous system. The aim of the presents preliminary study was to investigate the speech understanding in background noise despite normal hearing thresholds by using a battery of behavioral audiological tests in coffee-drinking individuals.

MATERIALS and METHODS: This study included 6 individuals between the ages of 19-26 years (Mean: 23 yr; SD:1,6 yr) who were referred to Hacettepe University Otorhinolaryngology Department, Audiology and Speech Pathology Section with normal hearing sensitivity. Clinicians often request that patients refrain from consuming caffeinated beverages 24 h before speech in noise testing**.** Effects of caffeine on Speech in Noise Scores of individuals were evaluated under two conditions: after consuming 300 - 350 mg of caffeine before testing, and without consuming a caffeinated beverage for 24 h before testing.

RESULTS: There was a statistically significant difference between the caffeine and nocaffeine consuming ($p < 0.05$). The participants performed better speech in noise test scores after the caffeine consuming.

CONCLUSION: Our findings suggest that caffeine consuming can improve speech intelligibility in participants with normal hearing thresholds. Future research is needed to determine whether these results occur in different age groups and genders.

KEYWORDS: Speech in noise, caffeine, speech intelligibility

PERCEPTUAL EVALUATION METHODS - APPLICABLE FOR ELDER AND TECHNICAL INEXPERIENCED PARTICIPANTS?

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A well-established method to evaluate the subjective quality of signal processing algorithms is the MUlti Stimulus test with Hidden Reference and Anchor (MUSHRA). Howewer, practice shows that especially older, technical inexperienced participants are challenged by the complexity of this method. Objectives of this study are the introduction and evaluation of two adaptations of the original MUSHRA. The adaptations answer the purpose to make the handling more intuitive and therefore maximize the accessibility.

The first adaptation uses discrete buttons instead of sliders and restricts the total amount of stimuli per test-screen. The second adaptation uses a drag & drop interface and lets the user sort the stimuli from left to right. The original method and the two adaptations are evaluated by five different subject-groups, including elder and technical inexperienced participants with normal and impaired hearing. The control group consists of technical experienced students with normal hearing. The participants use each method 2x2 times (test and retest).

Test stimuli are conversation scenarios in three different noise settings at a signal-to-noise ratio of 2 dB processed by seven different noise reduction schemes. The new adaptations are assessed in comparison to the original based on objective measures like e.g. test-retest reliability, time exposure, differences in accuracy as well as by subjective ratings for each method.

Mean usability ratings for every method were higher in the retest. Results from the preference rating give evidence that the adaptations are preferred over the original test. Differences between the methods will be shown in more detail.

KEYWORDS: Subjective evaluation, quality, MUSHRA, hearing aid algorithms

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RATES OF EXTENDED-HIGH-FREQUENCY HEARING LOSS FOLLOWING MIDDLE-EAR SURGERY

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Middle-ear surgeries are typically associated with a high rate of hearing improvement and a low rate of sensorineural hearing loss in the conventional 250 Hz – 8 kHz range. Less well documented, however, are the relative rates of transient and permanent hearing loss at higher frequencies, which may be common following otherwise successful procedures. We documented the prevalence, severity, and permanence of hearing deterioration from 250 Hz to 16 kHz following stapedectomy, ossiculoplasty, and tympanoplasty in 88 patients. Hearing was measured preoperatively, and at 1 week, 1, 3, 6, and 12 months post-operatively.

Despite mean improvements in 250 Hz - 8 kHz thresholds, at week 1 there was a decrease in the highest audible frequency in 30/39 stapedectomy patients (77%), 8/21 ossiculoplasty patients (38%), and 9/16 tympanoplasty patients (56%). Although partial recovery occurred in most cases, 17/34 stapedectomy patients (50%), 4/20 ossiculoplasty patients (20%), and 8/19 tympanoplasty patients (42%) retained a loss in highest audible frequency at 12 months. The largest deterioration in average thresholds between 9 - 16 kHz at 1 week occurred for stapedectomy (14 dB), then tympanoplasty (12 dB) and ossiculoplasty (1 dB). After one year, this recovered to an average loss of 7 dB for stapedectomy and tympanoplasty, and 2 dB for ossiculoplasty.

The clinical importance of this loss is unclear, however our results suggest that extended high-frequency hearing thresholds may be a more

sensitive measure of operative trauma that may be used to determine the efficacy of interventions to protect the ear from surgical trauma.

KEYWORDS: Middle-ear, surgery, stapedectomy, tympanoplasty, ossiculoplasty, extended-high-frequency audiometry

THE RELIABILITY AND VALIDITY OF "DOKUZ EYLUL UNIVERSITY MENIERE'S DISABILITY SCALE" IN ASSESSMENT OF PATIENTS WITH MENIERE'S DISEASE: A PRELIMINARY STUDY

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Meniere's disease is an idiopathic syndrome characterized by endolymphatic hydrops. Vertigo attacks are accompanied by hearing loss, tinnitus and fullness of the pathological ear. Vertigo and imbalance effect negatively the functional level of patients. The aim of this study was to analyze the reliability and validity properties of Dokuz Eylul University Meniere's Disability Scale developed originally. ENT examination, clinical history and audio-vestibular evaluation were performed to 40 patients with definite Meniere's disease. Dokuz Eylul University Meniere's Disability Scale and Dizziness Handicap İnventory were administered. 18 of patients were male, 22 were female and the mean age was 46.8±12.6 years. Means of hearing thresholds were 53.2±25.7 dB HL at pathological side, and 18.9±14.8 dB HL at non pathological side. Dokuz Eylul University Meniere's Disability Scale was repeated twice by the same clinician. Attack period of 48.5±7.2 points out of a total average score of 65 points, and non-attack period total mean score of 85.9±27.6 points out of 195 points, while the overall total average was calculated as 134.5±29.9 points out of 260 points. Cronbach alpha coefficient was calculated as 0.904. İntra-class correlation value was found to be significant ($p<0.001$). As a result of this study, for evaluation and clinical follow-up of patients with Meniere's disease, Dokuz Eylul University Meniere's Disability Scale is a valid and reliable scale.

KEYWORDS: Meniere's disease, hearing loss, vertigo, disability, quality of life

AID FOR GOAL-ORIENTED REHABILITATION

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OBJECTIVE: This presentation covers a study that developed and tested a tool for hearing aid use goal setting and assessment.

DESIGN: The tool includes two parts: 1) goal setting and assessment (for hearing aid fitting and follow-up appointments) and 2) logbook (for period between appointments). The tool was developed, piloted, and tested in standard hearing aid appointments. For each hearing aid user, data included descriptive information, audiometric results, preferences for client-centredness, hearing aid outcomes, and audiologist's quantitative and qualitative evaluation of the use of the tool.

STUDY SAMPLE: This study involved 34 hearing aid users (59% first-time hearing aid users) and 6 audiologists in two hearing clinics: one public in the United Kingdom and one private in Canada.

RESULTS: The tool is applicable in clinical practice and facilitates hearing aid use goal setting and assessment, but is time-consuming. Audiologists reported the tool as significantly more helpful with first-time hearing aid users. Audiologists preferred the goal-setting and assessment part of the tool over the logbook and evaluated it as significantly more useful and convenient in younger hearing aid users.

CONCLUSION: This study showed that it is possible to develop a clinical tool that facilitates hearing aid use goal setting and assessment.

KEYWORDS: Hearing aid use, clinical tool, client perspectives, audiologist perspectives

A NEW HYPERBARIC OXYGEN THERAPY SOFTWARE FOR MEASURING HEAR LOSSES

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isleryaBaric, is a new computer software for electronic control used in hyperbaric oxygen therapy (HBOT) systems. HBOT is a simple concept that by increasing the transport of oxygen to body tissues, the improvement in the partial oxygen pressure of the tissue can be utilized to effect healing in a wide variety of medical conditions. Some of the more common conditions recognized by the Undersea and Hyperbaric Medical Society for HBOT as a primary or adjunctive treatment include CO-poisoning, necrotizing soft-tissue infections, radiation necrosis, crush injury, etc. isleryaBaric is a easy-to-use software with GUI and does not require any special installation or programming skills. Input parameters are highlighted at the top left of the main window: patient weight, compression rate, decompression rate, compression O2 purge flow rate, plateau oxygen purge flow rate, hyperbaric pressure, and treatment time. The software provides an automation system for secure operation of the chamber and measures some physiological parameters including hearing-loss test with flexible data-logging features. The hearing loss tests were conducted using a microcontroller-based simple audiometer. In conclusion, the system was provided to conduct both pure-tone and screening tests with automatic test option in hyperbaric environment.

KEYWORDS: Hyperbaric, hearing test, audiometer, software

COMPARISON OF SUPRATHRESHOLD INTELLIGIBILITY SCORES BETWEEN TWO DIFFERENT SPEECH AUDIOMETRY TESTS USING NONSENSE STIMULI

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OBJECTIVE: The purpose of the present study was to compare speech recognition scores between nonsense-monosyllabic and nonsense-disyllabic combinations of Modern Greek for both, men and women.

MATERIALS and METHODS: A monosyllabic speech-audiometry test consisting of two lists and a disyllabic one consisting of five lists were chosen as stimuli. Every list in both tests consists of fifty open-set phonemic combinations of the Greek language. All nonsense speech stimuli were presented at a suprathreshold level of 55dBHL bilaterally to seventy adults (35 males and 35 females) whose hearing was within normal limits.

RESULTS: Correlation analysis of the results revealed that gender is not a differentiating factor of success rates between men and women regarding each one of the seven nonsense lists. In addition, no interlist statistical significant differences were found at the 0.05 level for both speech recognition tests. However, intertest statistical significant differences were emerged for both, men and women.

CONCLUSION: Nonsense monosyllables and nonsense disyllables are not considered equal for clinical purposes.

KEYWORDS: Nonsense, monosyllables, disyllables, speech audiometry

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DEVELOPMENT OF SENTENCE MATERIALS FOR A SPEECH-IN-NOISE TEST IN THE GREEK LANGUAGE

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OBJECTIVE: The importance for measurement of the ability to understand speech in noise necessitated the aim of the present study, which was the development of sentence materials for the creation of a time efficient speech-in-noise test for native speakers of the Greek language.

MATERIALS and METHODS: Eight criteria were established for the development of the sentence materials. No more than ten lists could be developed with fulfillment of all criteria. Each list contains six sentences with five key words in each sentence. All sentences were evaluated twice for naturalness by 10 participants. The target speech and a four-talker babble were recorded on separate channels and were adjusted, with each sentence-babble combination of each list at a signal-to-noise ratio of 0, 5, 10, 15, 20 and 25 dB. In order to assess list equivalence, all lists were presented at the prerecorded signal-to-noise ratios binaurally to seventy adults with normal hearing. Each key word was scored as correct or incorrect.

RESULTS: The final ten lists comprise the first speech-in-noise test in the Greek language. Analysis of covariance revealed all lists to be equivalent for listeners with normal hearing. Also, no significant differences were emerged for male versus female speaker, gender and age of participants.

CONCLUSION: Further research with hearing impaired subjects is suggested, since normal-subject results alone are not adequate to determine list equivalence. In addition, for evaluation of hearing aid use, administration in sound field for unaided and aided conditions is recommended.

KEYWORDS: Speech-in-noise, signal-to-noise ratio, sentence materials

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DEVELOPMENT OF AN AUDITORY-VISUAL MATRIX SENTENCE TEST IN NEW ZEALAND ENGLISH

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Matrix sentence tests (Hagerman, 1982) consist of syntactically fixed but semantically unpredictable sentences, each composed of 5 words (name, verb, number, adjective, object). Test sentences are generated by choosing one of ten alternatives for each word to form up to 100,000 unique sentences (e.g. "Amy bought six dark hats"). Rather than recording these sentences individually, the sentences are synthesised from 400 recorded audio fragments that preserve coarticulations and provide a natural prosody for the synthesised sentence (Wagener, 1999). Matrix tests produced in this way have been developed in numerous European languages. We describe here the development of an adaptive speech-in-noise matrix sentence test in New Zealand English. The matrix words were modified from the British English matrix (Hewitt, 2007) to be appropriate for both New Zealand and Australian English.

However, we have made the important step of getting this type of matrix test to work in an auditory-visual mode for the first time, using recorded fragments of high-definition video. The key to the success of the auditory-visual test mode was the selection of edit points appropriate for both speech and facial expression, and the maintenance of the speaker's head in a constant position throughout the recording. Normalisation was achieved by generating fragment-specific intelligibility functions for the auditory-alone test mode in the closed-set presentation format, using both speech noise and multi-talker babble. This test shows great clinical promise, as auditory-visual tests are more representative of real-world communication than auditory-alone tests, and allow the assessment of a client's auditory-visual integration abilities.

KEYWORDS: Speech audiometry, matrix sentence test, auditory-visual integration

FIRST PRACTICAL EXPERIENCES WITH THE TURKISH MATRIX TEST IN GERMANY

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Pure tone audiogram does not well reflect the individual difficulties of understanding speech in noisy environments. Therefore specific speech intelligibility tests that are developed and optimized for usage in noise are used in diagnostics, hearing rehabilitation, and research.

Non-native listeners typically perform worse than native listeners although they show similar peripheral hearing abilities. Therefore, speech audiometry has to cover the listener's native language. Matrix type sentence tests are developed and optimized in a large number of languages to precisely determine speech intelligibility in noise. They are also suitable for application of a closed-set response format where the investigator does not necessarily need to understand the applied test language.

In this contribution we present the results of a first validation study of the Turkish Matrix test in Oldenburg, Germany. 49 native Turkish listeners with a variety of ages and hearing abilities participated in the validation measurements that were conducted half as open-set response format tests with a native Turkish investigator and half as closed-set response format tests with German investigators without Turkish language abilities.

If the prerequisite of sufficient reading abilities is given there was no problem to conduct the closed-set Turkish Matrix test with native listeners but non-native investigators.

Both test formats show comparable speech reception thresholds in noise (SRT) to validation data determined with the German Matrix Test. The normal-hearing participants of the validation study show about 1dB higher SRTs compared to the evaluation study performed in Ankara, Turkey and Oldenburg, Germany.

KEYWORDS: Speech audiometry, speech intelligibility in noise, speech reception threshold (SRT), matrix Test, Turkish

MODELLING MATRIX TEST INTELLIGIBILITY IN NORMAL AND IMPAIRED LISTENERS ACROSS LANGUAGES USING AUTOMATIC SPEECH RECOGNITION (ASR)

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The closed-set Matrix sentence intelligibility Test is advantageous not only in audiology for testing speech recognition across languages (review by Kollmeier et al, IJA 2015), but also for predicting individual speech recognition performance using a standard ASR system, thus yielding a close match with the performance of human listeners. The advantage of such an approach is a scalable set of assumptions about human speech processing to characterize individual factors and to differentiate between sensory and cognitive aspects of speech recognition in normal-hearing and hearing-impaired listeners. This contribution discusses the strengths and shortcomings of using an ASR system for this approach.

The ASR system uses Mel-frequency cepstral coefficients as a front-end and employs whole-word Gaussian Mixture/Hidden Markov Models on the back-end side. The ASR system is trained and tested with noisy matrix sentences on a broad range of signal-to-noise ratios. The ASR-based predictions of speech reception threshold of 50 % intelligibility are highly correlated with the measured data across 7 relevant noise conditions for 10 normal-hearing native German listeners (R^2=0.95, p<0.001). This result outperforms the predictions of the Speech Intelligibility Index, which show no correlation with the empirical data (R^2=0.00, p=0.987). Using the same approach for Polish and Spanish listeners with the same test format, a similar high predictive value of the ASR system can be shown. Also, a slightly modified approach is used to predict a range of psychoacoustical experiments and to evaluate the required properties of the physiologically and psychoacoustically motivated front-end of the recognizer.

KEYWORDS: Speech audiology, models of hearing, machine Learning, test standardization

APPLICATION OF SPEECH AUDIOMETRIC MATRIX TESTS WITH HEARING IMPAIRED PATIENTS: EXPERIENCES WITH CI PATIENTS

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Audiometric speech in noise testing is important in order to assess an individual's auditory ability to communicate in everyday (noisy) situations. Matrix sentence speech tests, based on an idea by Hagerman (1982), are internationally comparable speech in noise tests that use complete sentences to adaptively determine the speech reception threshold in noise. Since 1999, more than ten language versions of matrix tests have been developed. All available matrix tests have similar psychometric properties and are conducted with the same adaptive procedure. Thus, they are highly comparable across languages, which makes them ideal tools for speech audiometry in noise in different languages and/or countries/regions.

Because of a limited amount of speech material and a very controlled speech rate, matrix tests are well suited for use with CI patients. One of the most recently developed matrix tests is the Finnish matrix test (Dietz et al., 2014). Here, we report on the practical application of

the matrix test with hearing impaired patients, especially CI users. We present results of measurements with CI patients in Finland and compare them to experiences gathered in Germany with the German matrix test OLSA (Wagener et al., 1999).

In comparison to conventional speech audiometry with lists of short words, matrix sentence tests have a better test-retest reliability. In addition, they do not show the often encountered ceiling effect of word tests (Gifford et al., 2008). Besides Finnish and German, matrix tests are available in Turkish, English, French, Italian, Russian, Spanish and Polish. Further languages are being developed.

KEYWORDS: Speech audiometry, matrix sentence test, speech in noise testing, hearing diagnostics, speech reception threshold

PREVALENCE OF TINNITUS IN SCHOOL-AGE CHILDREN

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BACKGROUND: Tinnitus is not an uncommon symptom in the pediatric population. The prevalence of paediatric tinnitus has been reported as ranging between 6% to 37.5% in normally hearing children and from 23.5% to 58.6% in children with hearing loss.

OBJECTIVES: The aim of this study was to analyse the frequency of tinnitus reported by 7 and 12 years old children from Warsaw primary schools.

MATERIALS and METHODS: 15 199 first (6-7-year-old) and six grade (12-year-old) students from 173 primary schools in Warsaw in school year 2012/2013 were included into the study. All children from the study group had performed pure tone audiometry. Tinnitus appearance was assessed with the use of audiological questionnaire administered to children.

RESULTS: The prevalence of tinnitus in the study group was found to be 6,0%. The frequency of tinnitus was statistically higher in children with hearing loss comparing to those with normal hearing.

CONCLUSION: Tinnitus in the study group was not a very common symptom.

KEYWORDS: Tinnitus, school-age, hearing loss

THE USE OF A FAST METHOD FOR RECORDING SCHROEDER-PHASE MASKING FUNCTIONS TO ESTIMATE COCHLEAR PHASE CURVATURE

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Until relatively recently, the influence of signal phase on human perception has largely been disregarded. However, findings in the last 20 years have shown that altering the phase characteristics of Schroeder harmonic complexes changes their ability to mask other sounds (Kohlrausch & Sander, 1995). The difference in masking produced by different phases of Schroeder complexes is thought to be contributed by the interaction between the phase curvature of the auditory filter and nonlinear cochlear processing. Our aim in this study was to demonstrate the potential use of our newly developed fast method for recording Schroeder-phase masking functions to estimate basilar membrane phase curvature.

Schroeder-phase masking functions at 75 dB A masker level were recorded in six normal-hearing participants for 250 Hz, 500 Hz, 1000 Hz, and 2000 Hz using various fundamental frequencies and numbers of masker components. Cochlear phase curvature was estimated from the location of minima in Schroeder-phase masking functions. The estimated auditory filter phase curvature was negative at all tested frequencies, and approached zero as frequency increased. Scaling symmetry was not exhibited for frequencies <500 Hz. Phase curvature estimates at low frequencies contradicted estimates from animal studies, but were consistent with previous Schroeder-phase masking studies in humans (Kohlrausch & Sander, 1995; Oxenham & Dau, 2001; Lentz & Leek, 2001), indicating significant interspecies differences. Our findings suggest that the newly developed fast method of Schroeder-phase masking, with its 80% reduction in test time, may be a useful tool for psychophysical estimation of auditory filter phase curvature.

KEYWORDS: Cochlea, basilar membrane, phase curvature, Schroeder-phase masking

RESULT OF MANUAL THERAPY IN PATIENTS WITH SUBJECTIVE TINNITUS: TWO CASE REPORTS

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OBJECTIVE: The aim of this study was to evaluate the results of manual therapy in two patients with subjective tinnitus.

MATERIALS and METHODS: Two patients each of whom had persistent tinnitus for a minimum of 6 months, were enrolled in this study. Patient 1 was a 55 year old female. Patient 2 was a 43 year old male. Pure-tone hearing thresholds were measured at all standard frequencies from 0.25 to 8 kHz, and at 10, 12.5 and 16 kHz in two patients. Impedance audiomety, speech audiometry, assessment of tinnitus (includes pitch, loudness, minimal masking level, rezidual inhibition) were applied in both patients before treatment. Tinnitus Handicap Inventory, Visual Analog Scale, Beck Depression Inventory and SF36 questionnaire were also applied before treatment.

Manual therapy protocol was applied by same therapist over a period of 10 sessions, undertaken three times a week and consisted of: manual cervical traction, stretching, vertebral mobilization and massage.

All assessments were repeated after therapy.

RESULTS: Differences in the pitch and loudness and subjective measurement of tinnitus were obtained in two patients after thearpy.

CONCLUSION: Both patients reported improvement in subjective measurement of tinnitus. Manual therapy might be beneficial in patients with subjective tinnitus.

KEYWORDS: Manual terapy, tinnitus, health quality, tinnitus handicap inventory

RELATIONSHIP BETWEEN TINNITUS PITCH AND HEARING LOSS IN PATIENTS WITH TINNITUS

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In patients with tinnitus, there is no consensus in literature regarding the relationship between dominant tinnitus pitch and several audiometric parameters. Some studies found no systematic relationship, while others found a correlation with the frequency at the edge of hearing loss, the frequency where the hearing loss is maximal or within the frequency range of hearing loss. The goal of the current study was to evaluate the relationship between tinnitus pitch and audiometric parameters and evoked otoacoustic emissions in patients with tinnitus.

Forty-five males and 22 females with subjective non-pulsatile tinnitus ranging in age between 18 and 73 years (mean 47.91 year, SD 14.0 year) participated at the study. Pure-tone audiometry and measurements of transient evoked and distortion product otoacoustic emissions were performed. Pyschoacoustical characteristics of tinnitus were determined, as well as questionnaires regarding tinnitus were filled in by all the participants.

Concerning pure-tone audiometry, preliminary results indicate no relationship between tinnitus pitch and the frequency at the edge from clinical normal to impaired hearing or frequency with maximal hearing loss. The relationship between tinnitus pitch and these parameters adopted on transient evoked and distortion product otoacoustic emissions will also be reported.

The results of the current study concerning the exact relationship between tinnitus pitch and audiometric as well as evoked otoacoustic emission parameters could shed light on the generation mechanism of tinnitus. This will be discussed.

KEYWORDS: Tinnitus, pure-tone audiometry, transient evoked otoacoustic emissions, distortion product otoacoustic emissions

RESOUND LiNX TS AND RELIEF APP: FLEXIBLE OPTIONS FOR SOUND THERAPY

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ReSound LiNX TS is a recently introduced hearing aid incorporating the 3rd generation of 2.4 GHz wireless technology from ReSound. The LiNX TS has new features which provide greater end user benefit for individuals suffering from tinnitus. With the introduction of Nature Sound options and the Relief app for tinnitus, a variety of sound therapy controls are available for personalization including frequency shaping, amplitude modulation and environmental steering.

The LiNX TS incorporates an important development of 2.4 GHz wireless hearing aids to include the use of a Bluetooth Low Energy (BLE) radio to allow for transmission from an iPhone or iPad to the hearing instruments. This technology enables direct streaming of not only telephone conversations to the hearing instruments, but all other audio sources from the iPhone including music, movies, audio books, and countless mobile applications. This opens up a variety of options for individuals suffering from tinnitus, enabling them to stream any type of audio program or sound file from their iOS device to the LiNX TS hearing instrument, including the Relief app. The ReSound Relief app offers the ability for users to introduce sounds into their sound therapy program beyond what is provided from the hearing aids. This includes environmental sounds, music, personal imported sounds, as well as guided relaxation exercises. Sounds from the app can be streamed directly to LiNX TS hearing instruments. The Relief app can also be used independently with headphones for tinnitus sufferers with normal hearing.

KEYWORDS: Tinnitus, sound therapy, streaming

THE RELATIONSHIP BETWEEN OCULOMOTOR TESTS AND UNILATERAL CHRONIC TINNITUS: PILOT STUDY

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BACKGROUND INFORMATION: Although tinnitus is an important symptom for several vestibular pathologies, in patients with tinnitus, vestibular function has not been studied frequently. Objective: Current study was designed to determine the relation between oculomotor tests and unilateral chronic tinnitus. Material and Method: 16 patients (8 male- 8 female) with unilateral tinnitus, aged between 34 – 68 (= 49, ± 10.71 SD) years old classified according to Tinnitus Handicap Inventory (THI). Audiometric tests and tinnitus mapping were applied. Vestibular system was evaluated by a computerized VNG. Saccade velocity, saccade accuracy, saccade latency, pursuit gain, pursuit asymetry, optokinetic gain were assesed. Results: The audiologic tests revealed that twelve patients have bilateral, two patients have unilateral hearing loss and two patients have normal hearing. Tinnitus Handicap Inventory results changed from mild to severe. Vestibular functions compared between tinnitus levels. The results showed that oculomotor tests didn't show any significant differences according to tinnitus levels ($p>0.05$). Conclusion: It is known that neurophysiological factors may affect the results of VNG tests and tinnitus perception hyphothesis includes central mechanism such as disturbed sleep, stress, anxiety. Even though this pilot study revealed no statistical significance, we need further analysis with more data.

KEYWORDS: Tinnitus, oculomotor tests, VNG

EVALUATION OF AUDITORY STEADY-STATE RESPONSE WITH CHIRP AND MIXED MODULATED TONAL STIMULI IN YOUNG ADULTS WITH NORMAL HEARING

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Auditory evoked potentials are objective assessment that shows the integrity and functionality of peripheral and central auditory system. When auditory stimuli given, Neuroelectric potential occur in the brain activity and the nerves in the brain. This potential are called "Auditory Evoked Response".

The auditory steady state response (ASSR) is an auditory evoked potential (AEP) that can be used to objectively estimate hearing sensitivity in individuals with normal hearing sensitivity and with various degrees and configurations of sensorineural hearing loss (SNHL). The primary clinical application for ASSR testing is to estimate the pure tone audiogram in clinical populations across all ages that are suspected of having a hearing loss. The purpose of the study to investigate in normal-hearing subjects how the ASSR varies in response to chirp and mixed modulated tonal stimulus (1) to estimate the average differences between the behavioural hearing thresholds and the ASSR threshold (2).

After immittance measurements and pure tone audiometry tests done, chirp and mixed modulated tonal stimuli ASSR tests were applied. The two stimuli were used to record the ASSR from 20 normal-hearing (18-25 ages) test subjects.

Most researchers agree that, in the future, ASSR testing will play an important role in clinical audiology. Although a number of research has been done on the ASSR, an information resource center that will provide current evidence-based practice clinicians are still needed. Therefore it is necessary to collect normative data from healthy patients.

Chirp and mixed modulated tonal stimulus responses will be discussed and compared.

KEYWORDS: Auditory steady state response, mixed modulated tonal stimuli, chirp

COMPARISON OF THE VENG RESULTS AND DIZZINESS HANDICAP INVENTORY SCORES IN VERTIGO

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INTRODUCTION: Understanding of the balance problems in daily life by looking at only one evaluation method are not possible. While Videoelectronystagmografy (VNG) is one of the test battery for evaluating peripheric and central vestibular system,

Dizziness Handicap Inventory (DHI) is also one of the disease specific questionnaire for individuals with dizziness or balance problems with 25 item.

The aim of our study was to compare the results of VENG and DHI outcomes of patients admitted to our clinic with complaints of vertigo.

MATERIALS and METHODS: Dizziness Handicap Inventory and VENG are applied to the patients admitted to our clinic with complaints of peripheric vertigo. The results were categorized according to the patients's diagnosis.

RESULTS: Peripheric vertigo patients were divided into two main groups, first group is BPPV and second group is non BPPV patients. The results of both groups are discussed in comparison of VENG and DHI.

KEYWORDS: Vertigo, BPPV, VNG, DHI

THE EFFECTS OF SIGNAL TO NOISE RATIO OF AUDITORY CORTICAL RESPONSES TO EXPRESSIVE LANGUAGE DELAY

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Language delay is a deficiency in children to develop language abilities on the chronological age appropriate. The purpose of the study is to investigate the effects of signal to noise ratio of auditory cortical responses to expressive language delay.

This research was conducted in the Audiology Department of Istanbul University Cerrahpasa Faculty of Medicine. 20 children whose age's between 3-6 and diagnosed language delay were included in this study. The patients were evaluated as audiological and included participants within normal hearing limits. Auditory cortical responses have been tested by FRYE Hearlab ACE, receptor- expressive language skills were tested with the PLS -4 test battery. Patients; were tested in three sessions. Stimuli were sent in three ways. A) In a quiet environment, the signal intensity of 75dB SPL, B) SNR:0 (Signal:75 dB SPL, Noise:75 dBSPL, C) SNR:+10 (Signal:75 dB SPL, Noise:65 dBSPL. Results will be discussed.

KEYWORDS: Language delay, auditory cortical responses, SNR

ELECTRONEUROGRAPHY (ENoG) FINDINGS IN PATIENT WITH DIABETES MELLITUS

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Diabetes Mellitus (DM) is one of the most serious and cronic health problems that was causing diabetic polyneuropathy by damaging cells and neural structures. Early identification of neuropathy in diabetic patients is very important to prevent some unwanted complications. Electroneurography (ENoG) is one of the electrophysiological test method that measures the amplitudes and latencies of facial muscles compound action potential and gives informations about the facial nerve. The aim of this study is to determine the presence of neuropathy by using nerve conduction study in diabetic patients.

In our study audiological assessments of patients with a diagnosis of diabetes and ENoG tests were conducted. ENoG and audiological tests results of the diabetic patients were compared with non-diabetics. The diabetics group and control group results will be discussed

EVALUATING PATIENTS WHO HAVE VESTIBULAR DYSFUNCTIONS BY USING HEAD IMPULSE TEST AND COMPOSING CLASSIFICATION CRITERIA ACCORDING TO PATHOLOGIES

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Video Head Impulse Test is recording the eye movements of a patient, whose eyes are fixed to a spesific target while the clinician applies some small angled head movements with unpredictable direction and velocity, via a video camera. Semicircular canals and vestibular nerve branch which is inerves semicircular canals, evaluates with Video Head Impulse Test at every plane. The goal of this study is evaluating patients who have vestibular dysfunctions by using head impulse test and composing classification criteria according to pathologies.

This study was conducted in Cerrahpasa Faculty of Medicine, Department of Audiology, University of İstanbul between December 2014 and March 2015. The patients groups which have unilateral/bilateral vestibular dysfunction were tested. The results of the patients were compared to the results of normal individuals.The results of similarities and differences between normal and vestibular dysfunction patients has been discussed.

NORMALIZATION OF REUR (REAL EAR UNAIDED RESPONSE) FOR 0-2 AGES

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SPL(Sound Presssure Level) as a function of frequency, at a specified measurement point in the ear canal, for a specified sound field, with the ear canal unoccluaded. The term real-ear measurement (REM) is used by audiologist to cover a range different measurements of the real acoustical characteristics of hearing aids. In clinical Audiology, the purpose of real-ear measurement is to compare and verify the real-ear acoustical characteristics of a hearing aid with a prescription target. This document also provides some guidance on the use of prescription targets.

The aim of this study is to measure the sensitivity and determine normalization at REUR for 0-2 ages.

This study has been conducted in Cerrahpaşa Faculty of Medicine, Department of Audiology, University of Istanbul between 2014 September and 2015 March and it is conducted with 50 participants with normal ear canal. Subjects have normal otologic evidence. Risk factors, sex, birth weight, week of birth were considered. FONİX FP35 Hearing Aid Analyzer and Otometrics AURICAL were used to evaluate the REUR for 0-2 ages. It was observed that the external ear canal resonance has shifted to low frequencies with maturation. All the results were discussed as a parameter of maturation.

KEYWORDS: Real-ear measurement, normalization

COMPARISON OF RESONANCE FREQUENCY CHANGE IN MULTI FREQUENCY AND WIDEBAND TYMPANOMETRY MEASUREMENTS IN YOUNG ADULT WITH NORMAL HEARING

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Tympanometry is a sensitive, inexpensive, non-invasive, and simple method for the diagnosis of middle ear disease. Compared with conventional tympanometry, multifrequency tympanometry provides more information about middle ear resonance and wideband tympanometry is also the new approach to performing middle ear assessment that gives more diagnostic information than conventional tympanometry.

Fifty normal-hearing adults (100 ears) who have aged between 18 to 25 years (20 male, 30 female) participated in this study. The differences between resonance frequencies in multi frequency tympanometry and wideband tympanometry were detected in young adults with normal hearing at İstanbul University Cerrahpaşa Medical Faculty Hospital, Audiology Department.

Resonance frequencies of 100 ears were detected with Multi-frequency tympanometry and wideband tympanometry. Results were compared and discussed.

KEYWORDS: Multi frequency, tympanometry, wideband, resonant frequency, middle ear

LONG TERMS EFFECT OF SURGICAL TECHNIQUE ON ELECTRODE IMPEDANCE CHANGE AFTER COCHLEAR IMPLANTATION

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Cochlear implantation is an founded treatment for selected persons with bilateral severe to profound sensorineural hearing loss who get limited gain from hearing aids.

The purpose of the present study was to compare the impact of cochleostomy (Cochl) and round window (RW) approaches to electrode insertion on intracochlear impedance changes.

This study aims to research changing impedance values long terms effect of surgical technique in cochlear implants. It is performed by using archives from İstanbul University Faculty of Cerrahpaşa Medicine, Departmant of ENT.

110 (54 Male, 46 Female) CI (cochlear implant) users whose the age range between 3y and 66y were included.

Retrospective records review of intraoperative and postoperative cochlear implant electrode impedances. We evaluated effect of surgical technique on intraoperative and post operative impedance measurements for apex, medial and basal electrodes. Participants' current values of all by using electrode impedance telemetry method record. In this way, we have compared between two groups of surgical technique which insertion trough the round window (RW) and cochleostomy (Cochl). Difference between RW and Cochl on impedance change have evaulated. Findings of the study has been discussed.

KEYWORDS: Cohlear Implant, round window, cochleostomy, impedance

A SURVEY OF DEMOGRAPHICAL CHARACTERISTICS AND FACTORS EFFECTING DEPARTMENT PREFERENCES OF AUDIOLOGY STUDENTS

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Although audiology is a relatively new program, it has grown remarkably for last 50 years in our country. The current students of audiology can look forward to a future within a dynamic professions, meeting needs of an expanding patient base. The aim of this study is to examine the factors effecting audiology students' preferences for choosing Audiology Department and their demographic chracteristics. This study was conducted at the Universities located in İstanbul. In this study, the correlation between the student's social and economical characteristics (age, gender, education level, income level occupation, family size) and their Audiology Department preferences are searched.

In this study, the name of the survey 'Demographical Characteristics and Preference Reasons' is used. This survey is used for data collection and consist of two parts. The first part consist of 18 questions to identify the demographical characteristics. The second part is to identify the reasons of student's to choose Audiology Department. The age of the participants were ranged between 17 and 34. The demographical factors such as age,sex,family structure and educational level are being examined in this study. All the datas are being collected and the results will be discussed and investigated.

KEYWORDS: Audiology students, demographical characteristic, preference reasons

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Poster Presentation Abstracts

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TAKE HOME EXPERIENCE WITH THE TV STREAMER FOR THE APPLICATION IN EXPERIENCED COCHLEAR IMPLANT RECIPIENTS

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OBJECTIVE: The Cochlear Wireless TV Streamer (with CE mark approval) sends stereo sound from a TV, or another audio device, directly to cochlear implant sound processors. The patient does not need anything extra, i.e., no cables or wires. The TV Streamer balances sound between the TV and the surroundings, enabling patients to watch TV, take part in conversations and keep track of what's going on around them. There is a distinct lack of post market user experience with accessories complementing a subject's own cochlear implant sound processor. This post market follow-up investigation was initiated to establish a unified approach to gain post market subjective user experience of accessories to support cochlear implant recipients.

MATERIALS and METHODS: Thirty experienced Nucleus 6 recipients were recruited in a prospective evaluation where they acted as their own control. A questionnaire was issued to be completed by the subjects during the 1 week take home trial period. The self-assessment was conducted to evaluate the subjective user experience while watching TV with the recipient's own sound processor and with the TV Streamer. The individual handling and listening benefit was rated with the wireless accessory in a variety of different TV listening setups and surroundings. This was done with both normal hearing and hearing impaired subjects in order to record the CI recipient's experience using the accessory with different mixing ratios to identify recommendations for different listening setups.

RESULTS: First results of the subjective benefit rating and recommendation recorded in the individual self-assessment questionnaires showed that the TV Streamer decreases the listening effort significantly while watching TV in a crowd of hearing impaired and normal hearing subjects. The benefit of the listing experience is highly affected by the mixing ratio. Final results will be presented at the conference.

CONCLUSION and RECOMMENDATIONS: This evaluation revealed the significant improvement possible with the TV Streamer. This would also apply for stereo streaming of the TV signal simultaneously into bimodal and bilateral cochlear implant subjects.

KEYWORDS: Wireless, cochlear implants, accessories

SOUND LOCALIZATION IN BILATERAL ACTIVE MIDDLE EAR IMPLANT USERS

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OBJECTIVE: Normal hearing persons use binaural cues to detect the source of a sound. In hearing impaired patients soundprocessing is limited which degrades their ability to localize sounds. In this retrospective study we investigated the sound localization ability of bilaterally implanted active middle ear implant users.

MATERIALS and METHODS: Sound localization was tested in an anechoic chamber in four conditions: 1. Unaided, 2.+3. Unilateral use of the audioprocessor (left/right), 4. Bilateral use of both audioprocessors.

Broadband noise stimuli were delivered from 11 loudspeakers in the frontal horizontal plane. Ten adults with moderate to severe hearing loss and bilaterally implanted with a Vibrant MED-EL Soundbridge were included in the study.

RESULTS/CONCLUSION: Independent of the test condition all subjects had a maximum percentage of 46% correct answers. Using only the right or left audioprocessor this score dropped to 33%. A Repeated measures ANOVA confirmed that the subjects localized significantly worse when unilaterally aided (left/right) than when unaided or bilaterally aided. Between the latter two conditions only a small, yet not significant difference was seen, indicating that the bilateral use of the implant increases slightly the ability of sound localization.

Overall, the soundprocessing of the middle ear implants did not negatively affect the human mechanisms of sound localization, but it did also not restore the subjects' localization ability so that they could compete with normal hearing persons. It is

supposed that the biggest advantage of middle ear implant use is experienced in the localization of soft sounds which are inaudible in the unaided condition.

KEYWORDS: Sound localization, middle ear implant, binaural hearing, bilateral

STAGED APPROACH TO THE TREATMENT OF CHRONIC OTITIS MEDIA WITH EFFUSION IN ADULTS

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Different conservative and surgical techniques are used to treat chronic otitis media with effusion (COME).

The study was aimed at the development of staged treatment algorithm for adults with COME.

18 patients with COME aged 18 to 62 were involved in the study. All the patients previously underwent conservative treatment: mucolytic agents, decongestants and politzerization. 5 patients also underwent multiple tympanic cavity shunt procedures (TCSP). All the patients were examined according to the protocols of diagnostics. Patients with organic obstruction of auditory tube were excluded.

Intranasal corticosteroids were administered against the background of general conservative therapy. Politzerization with automated air feeding system was daily made for 3 days with pre-anemization of auditory tube opening using decongestant solution under endoscopic control. The change of tympanic cavity pressure no less than 15 mPa as compared to the pressure before politzerization, the change of tympanometric curve type (spike appearance) and reduction of air-bone gap according to audiometry data were the criteria of effectiveness.

The treatment effectiveness was registered in 7 patients (38.9%) at this stage. TCSP was performed in the absence of forenamed signs for 3 days using standard deaeration tube and the one for prolonged wearing: 7 (38.9%) and 4 (22.2%) patients, respectively. 8 patients after TCSP also underwent nasal surgery of different extent.

Conversion to invasive treatment techniques should be strictly individual and realized only after conservative stage and its assessment as ineffective on the strength of developed criteria. Complex conservative treatment of COME may be effective in 38.9% of patients.

KEYWORDS: Otitis media with effusion, deaeration tube, politzerization, tympanometry

OPTIMIZATION OF THE DIGIT TRIPLET SCREENING TEST

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Adaptive speech-in-noise tests allow for the fast and/or precise assessment of supra-threshold speech perception. Screening versions like the digit triplet test (DTT) can be used for the quick detection of hearing problems or to raise awareness about noise-induced hearing loss. In this study, we discuss several variations of the currently used DTT procedure.

17 normal-hearing (NH) and 34 hearing-impaired subjects were evaluated with 5 variations of the current procedure: (1) The baseline test with broadband stimuli and a fixed step size of ±2dB per triplet, (2) a 15dB low-pass filtered version to increase sensitivity for high-frequency hearing loss, and (3-5) three digit-scoring versions with adaptive step sizes targeting the 24, 50 and 76% point of the psychometric curve.

The low-pass version resulted in the same test-retest error, duration and correlation with pure-tone thresholds as the baseline version, with a 13dB decrease in speech reception thresholds (SRTs) for NH subjects. The digit-scoring version targeting the 76% point maintained the same SRT, duration and correlation, but also achieved significantly lower test-retest errors.

While the low-pass DTT combines supra-threshold SRTs and pure-tone audiometric thresholds, no significant improved correlation with the latter could be found. Digit scoring results in lower test-retest errors than triplet scoring, allowing for a more precise or faster SRT determination. Depending on the used step sizes, different points on the psychometric curve can be targeted to quickly reconstruct the complete curve.

KEYWORDS: Adaptive procedure, speech-in-noise, low-pass noise

PAEDIATRIC COCHLEAR IMPLANTATION IN FEDERATION OF BOSNIA AND HERZEGOVINA: REGIONAL DIFFERENCIES

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OBJECTIVE: Bosnia and Herzegovina is one of the poorest country in Europe. We made overview of the first years of Cochlear implant (CI) project in Federation of Bosnia and Herzegovina.

MATERIALS and METHODS: Retrospective study: start of the CI project, number of implanted children, age of implanted children, start and number of CI surgery without supervision, organization of rehabilitation prosess.

RESULTS: Federation of Bosnia and Herzegovina is one of two parts of Bosnia and Herzegovina (less then 2 million of inhabitans). CI project implemented in three centers: Tuzla, Sarajevo, Mostar. Year of start of project was in Tuzla 2001, in Sarajevo 2002 and in Mostar 2008. Until January of 2015, in Tuzla performed 40 CI surgeries, in Sarajevo 40

and in Mostar 15 CI surgeries (total 95). Mean age of implantation was in Tuzla 54 months (min. 21 -max.144), in Sarajevo 38 (min. 20-max. 189) and in Mostar 45 months (min. 19- max. 120). In Tuzla, 21 CI surgery were performed withour supervision (from 2003 year), in Sarajevo 29 CI surgery (from 2003 years), and in Mostar there was not CI surgery without supervision until now. In all three centers performed rehabilitation process: in Tuzla at ENT clinic, in Sarajevo in separate Center for rehabilitation outside of the ENT clinic, and in Mostar in Public Health Center; with differences in success of rehabilitation.

CONCLUSION: It can be concluded that CI can be implemented even in such conditions like bad financial situation in country, postwar conditions, non-functional organization of health system.

KEYWORDS: Cochlear implant, children, experience

QUALITY OF LIFE OF PATIENTS WITH SUSPECTED HEARING REDUCTION

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Recently, specific relationships between individual health status, intrinsic and extrinsic factors in their influence on deaf adult quality of life outcomes were outlined. The objective of this study was to assess the incidence rate hearing reduction among a random adult sample. In 2013-2014, we investigated a total of 140 patients, 75 females and 65 males, aged between 24 and 81 years in the city of Varna, Bulgaria. This was the first hearing examination in life in 85 of them (in 60,71% of the cases). We used pure tone audiometry, air-bone gap, functional gain, speech audiometry, tympanometry, and otoacoustic emissions. The audiometric examinations identified hearing reduction in 36 patients (in 25,71% of the cases). Of them, 22 aged between 48 and 81 years presented with presbyacusis. Other 14 patients aged between 35 and 81 years presented with neuritis of the acoustic nerve and displayed alterations of the otoacoustic emissions as well. The tympanometric abnormalities in 23 patients did not correlate with audiometric data. No previous harmful exposures to loud noise were reported at all. We could conclude that hearing reduction worsens individual's quality of life and the incidence rate of the neuritis of the acoustic nerve in our contingent is relatively high which necessitates the timely application of hearing prosthesis, especially in young patients.

KEYWORDS: Hearing loss, hearing examination, pure tone audiometry

SPECIAL AUDITORY TESTS FOR IDENTIFYING DIFFERENT DEGREES OF PRESBYCUSIS

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Age related hearing loss (presbycusis), is one of the most common sensory defects in the ageing population. Presbycusis is characterized by the deteriorated processing of temporal sound features as well as by a decline in speech perception, thus indicating a possible central component. In our previous work (Profant et al., 2013; 2014; 2015), we identified components of presbycusis that were based on the deterioration of the central auditory system and were less dependent on peripheral hearing loss.

The aim of this project is to identify different degrees of presbycusis based on complex auditory testing aimed at improving future compensation of hearing loss.

The following auditory tests were employed: laterogram, binaural speech chopper, gap detection threshold, difference limen in temporal course of two clicks, frequency modulation, amplitude modulation, binaural masking level difference, hearing threshold of tone pips, speech audiometry, speech audiometry in noise, high frequency audiometry, dichotic speech tests (simple and complex sentences), otoacoustic emissions.

Twenty-five elderly adults and 25 young controls were examined using the hardware version of the device (the software version is currently under construction). So far, we have obtained a wide range of results in the elderly group that surpasses the results from basic auditory testing used in clinical practice (pure tone audiometry up to 8 kHz, speech audiometry, OAE).

Our results suggest that different degrees of presbycusis may exist, presumably originating from central components that are only detectable by using a battery of auditory tests.

KEYWORDS: Central presbycusis, auditory tests

THE OBSERVATION OF THE RESIDUAL HEARING IN PATIENTS WITH POST-LINGUAL HEARING LOSS AFTER THE COCHLEAR IMPLANTATION - A PILOT STUDY

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It is critical to preserve the residual hearing function as best as possible during the cochlear implant procedure in patients with residual hearing. The detailed mechanism of damaging hair cells and neurons of ganglion spirale cochleae caused by the inserting of the electrode is not known. The significance of the damage risk factors has not been fully established. Our pilot study is done in 15 patients with residual hearing in the cases of post-lingual hearing damage. In these patients the cochlear implant procedure was done by one surgeon using always the same electrode bunch and the same surgical technique. In

all patients the results of the pure tone audiometry and speech audiometry before and after procedure have been recorded. The intensity and duration of the noise burden during the operation have been recorded. The postoperative audiometric observation was done at different time points in order to establish the dynamic of the hearing level changes. We also observed the occurrence of surgical complications and the laboratory parameters. In several patients corticoid treatment has been used as the otoprotective medication. Although we don´t consider the results statistically significant due to a small group of patients at this point, we continue this research study. Hopefully, with the growing number of subjects, we will be able to define the risk level as well as to assess a suitable system for timing of the residual hearing audiometric recording. Such data could contribute to the correct and the early approach to the otoprotective therapy.

KEYWORDS: Cochlear implantation, hearing preservation, pilot study

HEARING LOSS IN ENDEMIC (BALKAN) NEPHROPATHY

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OBJECTIVE: To evaluate audiograms in dialysed patients with or without diagnose of endemic nephropathy and correlation between parathyroid hormone, endemic nephropathy and auditory thresholds.

MATERIALS and METHODS: Case control study. In period of 18 months, series of pure tone audiometry were done in dialysed patients. Patients were divided in four groups depending of endemic nephropathy diagnosis and levels of parathyroid hormone (PTH). Investigations were done on ENT Department General Hospital „Dr. Josip Bencevic", Slavonski Brod, Croatia.

RESULTS: The study included 121 patients. Mean age was 62 years, 52,9% were males, 47,1% were females. The average hearing threshold to 1,5 kHz was 10dB, ranging up to 45dB at 8kHz. Average number of months on hemodialysis was 46, and more than half patients had elevated levels of parathyroid hormone. 51,2% patients had endemic nephropathy. There was no statistically significance between years of hemodialysis and auditory thresholds. Also, there was no statistically correlation between PTH levels, endemic nephropathy and auditory thresholds. However, there was statistical trend of hearing loss on the right ear for patients with endemic nephropathy, regardless of the values of PTH in relation to renal patients of other etiology.

CONCLUSION: There is no statistically significant correlation of hearing loss in patients with endemic nephropathy due to other etiopathogenesis of uremic syndome.

KEYWORDS: Hearing loss, Balkan nephropathy, dialysis, auditory threshold, parathyroid hormone

EARLY INNERVATION AND DIFFERENTIATION OF CELLS IN THE HUMAN ORGAN OF CORTI

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OBJECTIVE: Knowledge on spatio-temporal interplay of factors controlling differentiation and innervation of cochlear cells in human inner ear is essential for understanding of normal hearing function. Similar studies on the early human inner ear are missing.

MATERIALS and METHODS: The immunolocalization of different factors controlling apoptosis (caspase-3), innervation (PGP9.5), differentiation (nestin) and cilia detection (α-tubuline) in cochlear cells was histologically analyzed in 6 human conceptuses, 5th to 10th weeks-old.

RESULTS: During the analyzed developmental period, otocyst epithelium displayed initial differentiation into the cell of organ of Corti. Throughout the investigated period, apoptotic caspase-3 positive cells were mainly distributed at the luminal and basal surfaces of labyrinth epithelium. Apoptosis co-localized with entrance of nerve fibers (visualized by PGP 9.5) into the basal parts of sensorineural cochlear epithelium. Expression of intermediate filament nestin characterized basal parts of cochlear cells, nerve fibers and cochlear ganglion cells. Protein α-tubuline was first detected in primary cilia of both epithelial and mesenchymal cells in the labyrinth, while later on characterized stereocilia on the surfaces of hair cells. Conclusion The described expression pattern indicates importance of early innervation of otocyst for differentiation of specific cells within the organ of Corti. Basal apoptosis seems to be associated with cochlear innervation, while luminal apoptosis with selective thinning of the cochlear epithelial wall. Expression of nestin and primary cilia characterized immature cochlear cells, while appearance of stereocilia characterized differentiation of hair cells. Alterations in spatiotemporal interplay of investigated developmental factors might lead to disturbances in cochlear cells morphogenesis and hearing function.

KEYWORDS: Human development, organ of Corti, apoptosis, innervations, differentiation

AUDIOLOGICAL MANAGEMENTS OF PEDIATRIC PATIENTS RECEIVING COCHLEOTOXIC DRUG THERAPIES

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We define ototoxicity as the temporary or permanent perturbation of the auditive, vestibular or both functions, which are induced by certain therapeutic drugs.

Alterations can be Cochleotoxic or vestibulotoxic.

Our protocol about toxicity on oncology patients, is focused on cochleotoxic affectation, to patients who receive platins and/or radiotherapy as a treatment. The objective is standardize these monitoring:

- Evaluate the hearing thresholds previously to the oncological treatment.
- Detect any degree of hearing loss during chemotherapy treatment.
- Detect any degree of hearing loss in a long term after treatment.

The aim of audiological exams is to know hearing thresholds in order to prescribe adequate therapy.

That means the patient will be followed-up, interdisciplinary and periodically, by Oncology and ENT specialists and pediatric audiologists, as well.

We want present a poster specifying our protocol and a real case of a child who suffers hearing loss induced by oncological therapy and his evolution in time.

KEYWORDS: Oncology, ototoxicity, sensorineural hearing loss

HEARING AND SPEECH UNDERSTANDING WITH A SIMULATED BAHA ATTRACT PATHWAY

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OBJECTIVE: To compare hearing and speech understanding between the new, non-skin-penetrating Baha Attract system and the current Baha system using a skin-penetrating abutment before the first patients received a Baha Attract system.

MATERIALS and METHODS: Hearing and speech understanding were measured in 16 experienced Baha users. The transmission path via the abutment was compared to a simulated Baha Attract transmission path by attaching the implantable magnet to the abutment and then by adding a sample of artificial skin and the external parts of the Baha Attract system. Four different measurements were performed: bone conduction thresholds directly through the sound processor (BC Direct), aided sound field thresholds, aided speech understanding in quiet, and aided speech understanding in noise.

RESULTS: The simulated Baha Attract transmission path introduced an attenuation, which started from approximately 5 dB at 1000Hz and increased to 20–25 dB above 6000Hz. However, aided sound field threshold shows smaller differences and aided speech understanding in quiet and in noise does not differ significantly between the two transmission paths.

CONCLUSION: The Baha Attract system transmission path introduces predominately high frequency attenuation. This attenuation can be partially compensated by adequate fitting of the speech processor. No significant decrease in speech understanding in either quiet or in noise was found.

KEYWORDS: Baha Attract, bone conduction, speech understanding, aided thresholds

DEVELOPMENT OF NORMATIVE DATA FOR A CANADIAN FRENCH WORDS-IN-NOISE TEST AND THE EFFECT OF BILINGUISM ON THE PERFORMANCE

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The "Test de Mots dans le Bruit" (TMB) includes four lists of 35 Canadian French monosyllabic words, recorded with a speech babble noise. The test items are presented at a signal-to-noise ratio of +5 dB HL, while the listener has to repeat the words after each presentation. The percentage of correctly repeated words can then be compared to normative data in order to determine the relative ability to hear in noise. The objectives of this study were to develop normative data for the TMB, as well as verifying the differences between monolingual and multilingual school-aged children on the test.

The normative data for the TMB have been developed with 122 school-aged children (6-12 years old) and 44 adults (21-45 years old). The results show developmental effect. Younger participants have lower percentage of word recognition in noise compared to older participants. The effect of the number of spoken languages has been verified with 36 Canadian French speaking school-aged children. The results suggest that school-aged children speaking more than one language have lower percentage on the TMB, than monolingual children.

These results have some clinical implications as the establishment of normative data applicable to different age groups for the Canadian French speaking communities contributes to improving the lack of available standardized clinical tools for this population. Furthermore, it appears that bi- or multi-linguism may have some effect on the ability to hear speech in noise even in the first language learned.

KEYWORDS: Hearing in noise, words-in-noise test, bilinguism

COMPARISON OF BROADBAND CHIRP STIMULUS AND TONE BURST STIMULUS IN VESTIBULAR EVOKED MYOGENIC POTENTIALS

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OBJECTIVE: To compare the results of cervical vestibular myogenic potentials (VEMP) using broadband chirp stimulus and tone burst stimulus in 500 Hz.

MATERIALS and METHODS: 32 normal subjects (18 male, 14 female), aged between 20 and 60, with normal otologic examination, no vestibular or neurologic complaints, airway thresholds better than 20 dB's between 125 and 8000 Hz, air-bone gap less than 10 dB's, normal acoustic immitansmetric findings participated in this study. VEMPs were recorded using Neurosoft Neuro-Audio Model and TDH 39 headphone. Ipsilateral records were obtained. Active electrode was placed on midportion of sternocleidomastoid (SCM) muscle, reference electrode on sternal end of SCM tendon and ground electrode on forehead.

RESULTS: We found mean P1 and N1 latencies for broadband chirp stimulus 8,33±0,52 ms and 16,1±0,64 ms respectively, and 12,77±0,40 ms and 20,9±1,07 ms respectively for tone burst stimulus in 500 Hz. There are statistically significant differences between both P1 and N1 latencies of VEMPs using broadband chirp stimulus and tone burst stimulus in 500 Hz ($p<0,01$ for both P1 and N1). There were no significant difference between P1-N1 interamplitudes of the two groups.

CONCLUSION: Broadband chirp stimulus is more reliable and stable alternative stimulus for assessment and interpretation of cervical VEMPs.

KEYWORDS: Chirp, tone burst, stimulus, VEMP

AUDIOLOGICAL FINDINGS IN A PATIENT WITH CHARCOT MARIE TOOTH DISEASE: A CASE STUDY

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Charcot Marie Tooth (CMT) disease is the most common inherited disorder of the peripheral nervous system affecting approximately 1 in 2500 individuals. CMT disease could be viewed as a specific type of auditory neuropathy. Weaknesses of hands and feet are often noticed with some cases clearly having auditory complaints. A 23 year old woman with CMT disease was evaluated audiologically. She had no auditory complaints. Pure tone and speech audiometry findings were normal. Abnormal auditory brainstem responses were found bilaterally. Latencies of waves İ, İİİ and V were extremely prolonged and, wave morphology was poor at the left side. Cervical vestibular evoked myogenic potentials were recorded. There was no response at the left side. Our results provide some evidence that in Charcot Marie Tooth disease the involvement of the Vİİİ cranial nerve is more frequent than clinically expected and is probably related to a demyelinated process.

KEYWORDS: Charcot-Marie-Tooth Disease, hearing, auditory brainstem response, cVEMP

UNILATERAL HEARING LOSS AFFECTS LANGUAGE DEVELOPMENT

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An increasing body of research suggests that children with unilateral hearing impairment lag behind with respect to their normal hearing peers. In view of possible interventions it is necessary to document their developmental outcomes. The aim of the present research is to examine auditory, linguistic and cognitive outcomes of children with unilateral hearing loss compared to those of age-matched normal hearing children of similar age.

A case–control study was carried out with 20 children with unilateral sensorineural hearing loss between and 5 and 15 years of age and age-matched normal hearing controls. Language, working memory, and speech in noise (presented to the good ear through headphones) were assessed by means of behavioral measures and aspects of hearing disability and academic performance by means of questionnaires.

Our results show that children with unilateral hearing loss score comparably to children with normal hearing with regard to speech in noise presented to the good ear, working memory and morphological language abilities, but lag behind in expressive vocabulary and syntactic language skills. Furthermore, questionnaires indicate that the unilaterally hearing impaired children experience problems in spatial hearing in daily life, and point to possible risks concerning their school behavior and attention in the classroom. Our data suggest early intervention for children with unilateral hearing loss to prevent speech language delays and reduced academic performance.

KEYWORDS: Unilateral hearing loss, children, speech- or language delay, academic performance

THE IMPORTANCE OF THE AUDIOMETRIC TESTS RESULTS OF GJB2 35DELG MUTATION CARRIERS

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OBJECTIVE: Mutations in the gap junction beta 2 (**GJB2**) gene are the most common cause of hereditary hearing loss especially in Mediterranean countries. The purpose of the study was to indicate the minimal differences of audiometric evaluations between the individuals with **GJB2** 35delG mutation carriers with normal hearing and non-carriers.

MATERIALS and METHODS: Twenty five carriers comprising 25 individuals with non-carriers were included. Pure tone air conduction hearing test at 125-14000 Hz, speech tests and middle ear pressure were applied to both two groups.

RESULTS: The pure tone hearing thresholds of non-carriers were significantly higher than carriers, within the normal limits ($p<0.05$). In the right ears of non-carriers and carriers, similar pure tone thresholds at only 2,000 and 14,000 Hz were observed. Considering the pure tone averages and speech reception test (SRT) results, significantly difference between **GJB2** 35delG mutation carriers and non-carriers was observed ($p<0.05$). Better pure tone averages and SRT results

were obtained in non-carriers. No significant difference was found in speech discrimination and middle ear tresholds between the groups.

CONCLUSION: The difference in pure tone hearing thresholds may be assumed to a micro-level effect of GJB2 35delG mutation on the auditory systems. Decrease in high frequency pure tone thresholds of carriers may indicate that they are affected by GJB2 35delG mutation at high frequencies even if there is no hearing loss. High frequency hearing thresholds are informative about base of the cochlea.

KEYWORDS: GJB2 35delG mutation, normal hearing, pure tone hearing threshold, speech reception test, speech discrimination.

THE EVALUATION OF PHONOPHOBIA IN PATIENTS WITH MIGRENOUS VERTIGO WITH THE HELP OF AUDIOLOGICAL TESTS

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The aim of this study is to assess Loudness Discomfort Level and Short Increment Sensitivity Index in patients with migrainous vertigo and evaluate the diagnostic role of these tests. The study was conducted with 20 subjects. The subjects were diagnosed with migrainous vertigo by the consultation of ENT, Neurology and Physical Medicine and Rehabilitation physicians. To detect the presence of phonophobia, Pure Tone Audiometer, Short Increment Sensitivity Index (SISI) and Loudness Discomfort Level (LDL) tests were applied to the subjects. They were also questioned about how they felt during attacks. Additionally, they evaluated themselves with Visual Analogue Scale (VAS). In consequence of the study, the median of LDL was 98 dB in phonophobia positive patient response while it was 110 dB in negative patient response ($p<0.05$). Similarly, the median of VAS was 30 mm in phonophobia positive response whereas it was 20 mm in negative patient response ($P>0.05$). Accordingly, LDL is found to be significantly lower in phonophobia positive patients. It is an indication that LDL might be an objective tool in the diagnosis of migrainous vertigo, especially in phonophobic patients.

KEYWORDS: Migrainous Vertigo, SISI, LDL, phonophobia

THE INFLUENCE OF SPEECH THERAPY ON FUNDAMENTAL FREQUENCY OF THE YOUNG MALES USING BILATERAL HEARING AIDS

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OBJECTIVE: The individuals with the sensorineural hearing loss have strain on control of the vocal organs and therefore have distorted voice. In this study, we evaluated the effect of speech therapy on the fundamental frequency of these individuals.

MATERIALS and METHODS: Six, bilateral hearing aid user due to sensorineural hearing loss male between 13 and 28 years of age, participated in this prospective randomized study. The voice analysis of the participants were made using Praat voice programme, in 16 byte 44000 Hz spectrum. High frequency vowel /a/ used solely and with /b/ for the records; reading lists had been given consisted of vowel+consonant, vowel+vowel, vowel+consonant+vowel, consonant+vowel+-consonant combinations. Speech therapy lasted for 6 months.

RESULTS: Before the speech therapy, the fundamental frequency (F0) of participants were ranged 182,443 Hz to 211,306 Hz, and mean F0 was 187,314 Hz. After the therapy F0 was ranged 119,486 Hz to 165,123 Hz, and mean F0 was 146,308 Hz.

CONCLUSION: There may be deteriorations of the voice of individuals with sensorineural hearing loss, even if they are using hearing aids. Increase in the fundamental frequency and shrillness can be seen especially in males. These deteriorations of the voice can be reversed by the speech therapy.

KEYWORDS: Sensorineural hearing loss, male, fundamental frequency, speech therapy

EFFECTS OF HEARING HANDICAP IN ELDERLY

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OBJECTIVE: The aim of the study is to evaluate effects of hearing loss in elderly patients and categorize the degree of challenges with HHI-E Turkish version.

MATERIALS and METHODS: HHI-E is a tool which is reliable and valid to define the hearing handicap in two subtests. In this study participants were categorized in three groups with HHE-I and subtest scores were compared with hearing loss degrees. 100 patients who were older than 65 years with hearing loss, participated.

RESULTS: Differences were found between scores of patients with mild, moderate and severe hearing loss. As expected the scores distributed positively which means if the hearing loss increase, the hearing handicap scores will also increase. However patients' life quality and expectancies could be effected by the scores and even patients with mild hearing loss are reported to have significant handicaps.

CONCLUSION: HHI-E is a useful tool to assess the negative effects of hearing loss in elderly patients. The need of habilitation program is indicated for elderly patients.

KEYWORDS: Elderly, hearing aids, handicap

NASOMETRIC ASSESSMENT IN CHILDREN WITH COCHLER IMPLANTS

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OBJECTIVE: Control of oral-nasal balance is difficult for profoundly deaf individuals. Especially hypernasality is a common speech problem of the deaf children. In the literatüre, a few studies investigated the effect of cochlear implantation on nasalance measures in profoundly deaf children. Yet, in Turkey there is not any study, as such. The aims of this study were to obtain nasalance scores in children with cochlear implants and determine the effect of cochlear implatation on nasalanece score.

MATERIALS and METHODS: This study included 4-18 years old, 8 children with cochlear implants. At first step, a personel information form was used as a data tool. Next, audiologic assesment was performed. Finally, nasalance measurements were obtained. The results have been analysed by SPSS version 22.

RESULTS: Nasalance scores compared with published normative data for pediatric individuals. Means nasalance scores for oral phonemes were significantly higher than the normative data. But means nasalance scores for nasal phonemes lower than the normative data. There was no significant correlation was found between nasalance scores and individual factors such as age, gender, the age starting use of the hearing aids and cochlear implatation, duration of cochlear implatation use and rehabilitation.

RECOMMENDATION: As a conclusion, we recommended that nasometric assesment can be used for speech teraphy program of childeren with cochlear implatation. Further studies including larger groups are needed.

KEYWORDS: Cochlear implantation, nasalance Scores, nasometry

TASK EFFECTS ON SEMANTIC PROCESSING OF WH SENTENCES IN SUBJECTS WITH AND WITHOUT AUDITORY PROCESSING DISORDERS: BEHAVIORAL AND ERP ANALYSES

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Assuming that complement moves to the beginning of the sentence causes greater distance from the verb, increasing the difficulty in detection of congruence versus incongruence, were studied the processing of interrogative sentences in subjects with and without Auditory Processing Disorders (APD) using behavioral and electrophysiological (ERPs) experimental paradigms.

METHODS (BEHAVIORAL): Sample: 37 adults Portuguese native speakers (3 with APD). Semantic judgment task: in auditory pathway subjects listen 240 congruent and incongruent interrogative sentences. Subjects had to decide whether the sentences were congruent or not. Reaction times (RT) and accuracy were recorded.

METHODS (ELECTROPHYSIOLOGICAL): Sample: 21 adults (3 with APD). The EEG was collected (referential; SI 10/20) and ERPs synchronous to the critical event were computed (averaging and regression to the mean 200ms baseline) separately for each one of the conditions.

RESULTS: Concerning behavioral data and regardless the semantic linguistic conditions (congruency vs incongruence between the verb and the complement moved to the beginning of the sentence), subjects with APD display always higher RT compared the subjects without APD: 856ms vs 705ms for the congruence sentences and 738ms vs 719ms for the incongruent sentences. Concerning electrophysiological data, both groups show an late negative waveform's amplitude significantly higher for incongruent sentences in left frontal and parietal EEG channel. However, in APD subjects, amplitude is more higher in the wave form.

CONCLUSIONS: The results suggest that subjects with APD process semantic information are differently from normal subjects: the higher amplitude of LPP suggests an increase attention state for semantic integration in these patients.

KEYWORDS: Auditory processing disorders, evoked related potentials (ERPs), semantic processing

THE EFFECTS OF EPILEPSY DRUG IN PATIENT WITH TINNITUS: A CASE REPORT

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The reasons of tinnitus may differ greatly. Unfortunately, in more than 60% of patients, even an extensive workup may not lead to diagnosis because the causes of the symptoms may be numerous. The aim of this case study is to reveal the relation between the use of epilepsy medication and chronic tinnitus. In the study, the case of a 13-year-old female patient diagnosed with refractory epilepsy is reported. At the age of 3,5, had her first seizure then began to use antiepileptic drugs. Presented in 2014, was reported that she had been suffering from chronic tinnitus in both ears and had difficulty in understanding speech in noise. Audiometric tests, ABR, THI and tinnitus mapping were applied. Initially THI (range 0–100) revealed a score of 78 indicating severe tinnitus. Audiometric thresholds from 125 Hz to 8000 Hz were bilaterally normal (except the notch of 6 kHz in right ear). Speech audiogram, tympanometry, ABR results and stapedius reflexes were normal on both sides. Presented low pitched tinnitus (right ear: 250 Hz, left ear: 500 Hz at 70 dB HL) with nonpulsative character. Because of no residual inhibition with masking and the difficulty in understanding speech in noise, the long term antiepileptic medication use was considered. First, offering counselling about tinnitus was considered, and then referred to the neurology department to reassess the medication. After the referral, THI score was 28. It can be concluded that there is a relation between tinnitus and the long term use of antiepileptic medication.

KEYWORDS: Tinnitus, antiepileptic medication, epilepsy

CONTRALATERAL SUPRESSION OF TRANSIENT OTOACOUSTIC EMISSIONS IN CHILDREN WITH FLUENCY DISORDERS

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OBJECTIVE: This study was designed to investigate the auditory system functions of the olivocochlear efferents in children with fluency disorders.

MATERIALS and METHODS: Sixteen children (n=32 ears) who stutter (Mean age±SD, 9.6±4.2 years) participated the study. After obtaining approval of local ethical committee and informed consents, all participants underwent otoscopic examination, audiometry (between 1 kHz and 4 kHz), Transient Evoked Otoacoustic Emissions and Transient Evoked Otoacoustic Emissions with contralateral supression. All participants had a hearing threshold of 10 dB HL by audiometry test.

RESULTS: There was statistically significant difference between TEOAE and TEOAE with contralateral supression test results (1.4 kHz and 2 kHz) of children with speech fluency disorders ($p<0.05$).

CONCLUSION: As a result, it was found that the decrease of the contralateral supression values of the children with fluency disorders. According to these findings, delayed auditory feedback in olivocochlear efferents system.

KEYWORDS: Stuttering, auditory efferents, hearing, otoacoustic emissions

COMPARISON OF CE-CHIRP ABR AND CLICK ABR METHODS IN PATIENTS WITH UNILATERAL TOTAL HEARING LOSS

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CE-Chirp stimulation was devoloped by Claus Elberling with the purpose of compensating cochlear neural delay. Due to the periodic range of frequencies that it contains, it helps receiving to the characteristic areas, which are located on the basilar membrane, at the same time. Click and CE-Chirp stimulations have the same frequency spectrum.

The aim of this study is to compare the data obtained from the patients with unilateral total hearing loss and the other ear having normal hearing threshold.

CE-Chirp ABR and Click ABR data of 71 male patients with unilateral total hearing loss were compared. Patients were sedated during testing. Both of the tests were conducted with 100, 95 dB, while normal hearing ear was masked. Normal hearing ears were tested with 80 dB and lower intensity.

The mean of CE-Chirp ABR test length was shorter than Click ABR's mean test length (14.57±3.9 minutes vs 17.91±3.8 minutes).

-The wave amplitudes of CE-Chirp ABR were higher than that of Click ABR's except 80 dB nHL.

-80 and 60 dB nHL latencies of fifth wave of CE-Chirp ABR was found shorter than Click ABR's (p:0,00), while CE-Chirp ABR was longer than Click ABR's in 40 dB nHL and lower hearing levels (p:0,00).

-CE-Chirp ABR (12,81 dB nHL) thresholds were found closer to 2-4 KHz behavioral threshold means (10,45 dB nHL) than click ABR thresholds (14,64 dB nHL).

CE-Chirp ABR was found to be better in assessing ears with total hearing loss and normal hearing.

KEYWORDS: CE-Chirp ABR, click ABR, unilateral total hearing loss

QUALITY OF LIFE OF PEDIATRIC PATIENTS WITH COCHLEAR IMPLANT

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Profound hearing loss is an impairment which affects individual's physical, social and psychological health. Cochlear implantation is a rehabilitative procedure, which is used for the eligible candidates who are chosen from individuals with severe to profound hearing loss. Quality of life of pediatric patients with cochlear implant are usually evaluated by parent proxy reports.

In this study, we investigated cochelar implant satisfaction of users by "Parents Perspective Questionnaire" and analyzed the parameters which might be have an effect to quality of life.

30 children (age 2-16 years) who are using unilateral cochlear implant for at least 6 months are evaluated by using "Parents Perspective Questionnaire" in Gazi University Department of Audiology, The questionnaire includes 11 subscales such as decision-making, self-confidence, communication, social relationships. Family satisfaction is investigated via these subscales. Additionally, relationship between family's educational status, patient's age and implant usage time subscales was assessed too.

Results indicated that implant users who are implanted for a longer time are better at some parameters like self-confidence, well being and social relationships, It was observed that as the implantation age decreases subscale scores increases which suggest that users life quality gets better.

Cochlear implant's positive effects on quality of life is a well known truth but parents might have concerns about preoperative and postoperative periods. Patients and parents should be informed carefully about process.

KEYWORDS: Cochlear implantation, quality of life, quality of life scale

OCULAR VESTIBULAR-EVOKED MYOGENIC POTENTIALS IN HEALTHY ADULTS

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INTRODUCTION: Vestibular-evoked myogenic potentials (VEMP) recorded from extraocular muscles, the so-called ocular VEMP (oVEMP), can be used to evaluate utricular function.

OBJECTIVE: The aim of this study is to determine the normal values of oVEMP in healthy adult population.

DESIGN: This study is designed to establish preliminary normative data for oVEMP induced by air-conducted sound stimuli in thirthy healthy adults. Thirteen male and seventeen female subjects aged between 20-58 (mean 33,34±13,41) were included into this study. During binaural air-conducted sound stimulation, oVEMP was recorded unilaterally. The thresholds, latencies and amplitudes of N1 and P1, peak-to-peak N1-P1 amplitude and asymmetry ratios (AR) of right and left sides were collected in all participants. Meanwhile, the effects of gender on oVEMP results were also investigated.

RESULTS: The thresholds and latencies of N1 and P1, N1-P1 interpeak amplitude and N1 and P1 AR of right and left sides in all participants were 85,17±5,08 dBnHL, 86,03±4,3 dBnHL, 9,9±1,15 ms, 10,19±0,82 ms, 15,04±1,37 ms, 14,83±1,09 ms, 5,2±3,27 microV, 4,12±3,17 microV, 29,74±18,94 % and 28,92±21,02 %, respectively. There were no significant differences between male and female adults in terms of oVEMP parameters. Between right and left ears, only N1 amplitude showed a significant difference.

CONCLUSION: It is concluded that, oVEMP should be interpreted regarding the thresholds, latencies and amplitudes of N1 and P1 waves of the right and left sides rather than asymmetry ratios. It is of paramount importance that each institution should determine its own normative values.

KEYWORDS: Ocular VEMP, healthy adults

ACOUSTICAL ANALYSIS OF TUNING FORKS

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Tuning forks (TFs), which are acoustical resonators produce one fundamental frequency (FF) and at least one overtone (OT) when vibrated. The intensity of OT decreases in hundred miliseconds, while FF continues as only audible frequency. TFs are used in otolaryngology practice for years. All metallic equipments are tended to fatigue and/or deformation in microstructure. Hence purpose of this study is to analyse acoustical properties of TFs which are in use for years.

In this study, we evaluated 1 new (TF1) and 15 (TF2-15) used TFs. The vibration sounds of TFs were recorded and then, these recordings were analysed with Praat sound analysis software in terms of frequency, intensity and duration.

TF1 produced 514 Hz FF and 3 OTs; its FF remained for 21 seconds gradually losing its intensity. However, TF2-15 presented variations: their FFs presented difference from the original FF (<1% in 3, 1%-10% in 8 and >10% in 4 TFs); The decay times of the FFs shown a huge variation (6.51 to 47.85%), the OTs presented more differences in frequency and decay times.

The data presents that TFs in use lose their acoustical characteristics by time, and major difference as related to the otolaryngologic practice is the narrowing of FF's decay time. Hence, we can pronounce that otolaryngologists should be attentive to duration of tuning of TFs used in their clinic, since many of TF tests are related with duration of sound perception. Further, we propose that acoustical analysis programs could be used for evaluation of TFs in clinics.

KEYWORDS: Tuning forks, acoustical analysis, fundamental frequency, overtones

ATYPICAL CHILDHOOD VERTIGO: A CASE REPORT

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OBJECTIVE: Vertigo is a common problem in children and results from a variety of reasons. However, uncommon type of vertigo may be observed occasionally. Our aim is to report a case of a patient with vertigo when he keeps his head in a vertical position.

PATIENT: A single patient who is nine years old complained about having vertigo, vomitting and malaise when his head is in a normal position since he was three years old. He could not hold his head vertically no more than five minutes. The patient is keeping his head tilted to left side to avoid vertigo and vomitting. Physically he looks as if suffers from torticollis but does not.

INTERVENTION: Computerized dynamic posturography (CDP), videonsytagmography (VNG) and positioning tests were performed in the vertical head condition.

RESULTS: All posturography findings were in normal limits. In terms of VNG, oculomotor tests were in normal limits and gaze horizontal, spontaneous nystagmus were not observed.

CONCLUSION: Although we do not know why he suffers from vertigo with his head in the normal position, we think that atypical childhood vertigo is observed in this case.

KEYWORDS: Vertigo, head tilt, childhood

THE EFFECT OF SIGNAL TO NOISE RATIO ON CORTICAL AUDITORY EVOKED POTENTIALS IN PATIENTS WITH PRESBYCUSIS

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The aim of the study was to determine the effect of signal-to-noise ratio (SNR) on the latency and amplitude of speech evoked cortical potentials in patients with presbycusis. P1, N1 and P2 cortical responses were recorded from thirteen patients in response to brief speech stimuli presented in various SNR levels. Amplitudes of the P1, N1 and P2 in quite condition were found to be 2.24μV±1.13; -5.54μV ±2.71 and 4.57μV±3.05 and latencies were found to be 42.6ms±9.3; 97.0ms±8.5 and 180.8ms±17.1 respectively. Amplitudes of the P1, N1 and P2 were decreased and latencies of the P1 and N1 increased with decreasing SNR. Morphology of the waves was determined primarily by SNR, highlighting the importance of background noise when recording cortical auditory evoked potentials in patients with with presbycusis.

KEYWORDS: Cortical auditory evoked potentials, CAEP, presbycusis, signal to noise ratio

EVALUATION OF THE SATISFACTION OF THE REAL EAR MEASUREMENT (REM) FITTED HEARING AIDS

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OBJECTIVE: Evaluating the satisfaction of the individuals using real ear measurement fitted hearing aids.

MATERIALS and METHODS: In this study IOI-HA-TR (The International Outcome Inventory for Hearing Aids – Turkish version) questionnaire, consisting 7 questions, was used. 271 hearing aid user individuals, ranged 50 to 70 years old age (132 female, 139 male) participated in this study. The real ear measurements of the subjects regarding up to date audiograms were made and appropriate ones included to the study. 1st, 2nd, 4th and 7th questions of the survey is about the utilization of the individual from the hearing aid, 3rd, 5th and 6th questions were about the communication skills with the social environment. Also influence of the duration of hearing aid usage and the degree and type of the hearing loss on the satisfaction were evaluated.

RESULTS: Considering the utilization of the hearing aid and communication skills with the social environment, male and female participants are satisfied ($p<0.05$). Participants using 3rd or more hearing aid are more satisfied than the individuals using 1st and 2nd hearing aid ($p<0.05$). While the satisfaction of the individuals with mild or profound hearing loss were limited, the individuals with moderate, moderately severe and severe hearing loss are satisfied ($p<0,05$). There were no statistically significant difference between types of hearing loss in terms of satisfaction.

CONCLUSION: Audiologic examinations and REM should be done regularly to increase satisfaction with hearing aids.

KEYWORDS: Hearing aid, real ear measurement, REM, satisfaction

CONSANGUINEOUS MARRIAGES AS A CAUSE OF CONGENITAL DEAFNESS (CASE OF UZBEKISTAN)

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An audiological study of 975 children with hearing loss (HL) on the stages of preoperative recruitment for CI was performed. HL cases because of consanguineous marriages (CM) were accounted at 57 children (5.8%), from them closely CM was 14 (1.4%). Hearing thresholds (ABR) in the study group averaged 95-100dB at 11 (19, 2%) kids, 85-90dB at 38 (66%) children, 75-80dB at 8(14 %) children. There were revealed the cases of «family deafness» when 2 deaf kids are available in 4 families and 3 deaf children are in 2 families. Pathological conditions, such as low birth weight were detected for the 8 (14.03%) children, critically birth low weight at the 5 (8,7%) children, hemolytic newborns jaundice in 16 (28%) cases, abnormal births in 9 (15.7%) cases, organic changes CNS (intraventricular hemorrhage) at the 11 (19.3%) children. The above conditions independently might be cause of HL.

Thus, consanguineous marriages in the genesis of the HL can play not only the primary genetic, but also indirect role, manifesting severe organic disorders, which in turn can be etiopathogenetic factor for congenital forms of deafness. Planned genetic diagnostics will help in determining of the differential correlation HL genesis and to predict the "family" form of HL.

KEYWORDS: Hearing loss, consanguineous marriage, family deafness

ABNORMAL COURSE OF ACUTE ACOUSTIC TRAUMA IN PATIENTS WITH ACOUSTIC NEUROMA

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OBJECTIVE: To demonstrate atypical course of acoustic trauma in two acoustic neuroma patietns

Material and methods

PATIENT: 1 – a 31 years old female and patient 2 – a 60 years old male, admitted to ENT department with diagnosis of acute acoustic trauma (patient 1 – right ear, patient 2 – left ear). Directly after niose trauma they complained of a sudden unilateral deterioration in hearing,

sensation of blocked ear, and sudden unilateral tinnitus. They had no tinnitus prior to acoustic trauma, no balance disorders. Both patients were professionally exposed to noise, having regularly their hearing checked. In both cases pure tone audiograms prior to acute acoustic trauma,were symetrical and showed no signs of acoustic trauma. On admission to hospital ENT examination revealed normal otoscopy bilaterally.

The hearing threshold in pure tone audiograms revealed atypical niche in the ears with acoustic trauma. Patient 1- the right ear – 0.25kHz-20dB, 1kHz-20dB, 2kHz-25dB, 3kHz-50dB, 4kHz-30dB, 6kHz-30, 8kHz-20dB. Patient 2- the left ear - 0.25kHz-35dB, 1kHz-80dB, 2kHz-70dB, 3kHz-50dB, 4kHz-60dB, 6kHz-75dB, 8kHz-70dB. In both patients in contralateral ear a typical niche for 6kHz was present.

In both patients ABRs showed a pathological prolongation of the Vth wave latency in the ear with atypical acoustic trauma course. MRI imiging revealed PCA tumor on the right side in patient 1, and left side in patient 2.

CONCLUSION: The presence of acoustic neuroma altered the course of acute acoustic trauma.

KEYWORDS: Acute acoustic trauma, acoustic neuroma

PATHOPHYSIOLOGICAL ALTERATION OF CONNEXINS IN HEARING LOSS PATIENTS

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Connexin 26 has a role in the cell-cell interactions and in the permeability of the channels for diverse ions and small molecules to maintain the physiological condition of the cochlea. However we have a modest knowledge on the impact of the altered gap-junctions in the inner in testing the hearing loss patients; and the level of Cx26 and Cx43 in the blood cells and neuroblasts. In this study we compared groups of patients with cochlear implants, hearing loss and tinnitus using objective measurements with distortion otoacustic emission method (DPOAE) and tympanometer. The patterns of expressed Cx26 and Cx43 have been altered in the three groups of patients and the normal Eustachian tube function was detected. As the middle ear ventillation found to be normal further objective measurements could be performed, thus these patients were included. In the cochlear implant candidates the outer hair cell functions were diminished, as part of the inner ear lesion, leading to complete hearing loss. This Corti-organ malfunction could be substituted by different cochlear implant systems. In the pathological group from mild to moderate/severe outer hair cell dysfunction could be detected, which could be explained by co-morbidity (i.e. hypertension), tinnitus and age or noise exposure in the case history. These results suggest that the physiologically active connexin channels are crucial to facilitate the flux and recycling of potassium ions from intracellular space between two plasma membranes maintain the normal hearing and the altered gap-junction exhibits distinct signalling mechanism. This work was supported by TAMOP-4.2.2.A-11/1/KNOV-2012-0052 and TAMOP-4.2.2.A-11/1/KONV-2012-0035.

KEYWORDS: Hearing loss, connexin 26, connexin 43, otoacustic emission, tympanogram

HEARING STUDY (THRESHOLDS, AUDITORY DISCRIMINATION AND MEMORY) IN UNIVERSITY MUSIC TEACHERS

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AIM: This paper aimed to study hearing thresholds, auditory discrimination and auditory memory, in quiet and noise, of university music teachers.

MATERIALS and METHODS: Musicians under 50 years old were evaluated, such as musicians over 50 years old. All the subjects presented type A tympanograms and air-bone gap less than or equal to 10 dB. A PTA was performed, in which 3 kHz and 6 kHz were also tested. In the auditory discrimination study, the teachers listened to a list of dissyllable words and pseudo words. They've repeated both words and pseudo words as heard. In the auditory memory study, in quiet and in noise, teachers heard sets of two, three, four and five pseudo words.

RESULTS: The musicians over the age of 50 showed worse hearing thresholds than those who were under 50 years old. Differences over 10 dB were verified from 4 kHz in both ears, between the two groups' mean threshold. Meaningful statistical differences were not found in the auditory discrimination and auditory memory tests between the two groups, although the performance of the group with age over 50 shows to be slightly better in the auditory memory test in presence of noise.

CONCLUSION: Results seem to indicate the non-reduction of both auditory discrimination and work memory aptitudes in musicians, university teachers with increasing age, even revealing a greater training of auditory memory in adverse environments for those older than 50 years old.

KEYWORDS: Pseudowords, auditory memory, musicians, noise

HEARING SCREENING OF STUDENTS IN THE FIRST GRADE OF SECONDARY SCHOOLS IN SIBERIA, RUSSIA

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The survey was attended by students of the first grade of four secondary schools in Krasnoyarsk city, Siberia, Russia. 558 children were examined. Prior to the survey, parents / guardians with children completed a questionnaire that included questions about the potential causes of hearing loss, tinnitus, possible difficulties in their studies.

The main test used in the survey was audiometry (air conduction). The survey was conducted in a quiet room in accordance with the procedure of determining the threshold of audibility. The thresholds of audibility were determined on frequency range from 250 to 8000 Hz. A positive result of hearing screening was accepted value of 25 dB or more at any of the frequencies at one or both ears.

RESULTS: In the survey of first grade students the positive result was obtained in 15.6% of cases (87 children).

Bilateral hearing loss was revealed in 26.4% of cases (23 children). Hearing loss at high frequencies was noted in one third of cases (34.9%). Unilateral left and right hearing loss was observed equally (30 and 33 cases, respectively).

One-third of children with identified hearing impairment had never been examined. It is also noted that children with hearing loss in 2 times more often than healthy children had low school performance - 10.4% of children with normal hearing and 18.4% of children with hearing loss have satisfactory marks at school.

KEYWORDS: Hearing screening, children, hearing loss

SPEECH AUDIOMETRY TESTS AND THE RANDOM GAP DETECTION TEST IN THE PROGNOSIS OF HEARING AID EFFICIENCY

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OBJECTIVE: to study the hearing aid (HA) efficiency depending on the results of the binaural fusion and the random gap detection test.

MATERIALS and METHODS: 20 patients with binaural symmetrical chronic sensorineural hearing loss, HA users were examined. Binaural fusion and the random gap detection test (RGDT) (Keith, 2000) were performed as well as standard tests. Speech audiometry in free sound field was used to evaluate the HA efficiency: polysyllable words both in quiet and in noise were presented, at first without HA and then with it.

RESULTS: Considering the speech intelligibility in the binaural fusion test the listeners were divided into 3 groups: 35-50%; 55-75%; 80-95%. Strong positive correlation between speech intelligibility in the binaural fusion test and in free-field speech tests was revealed. Mostly this correlation was shown while using HA and presenting speech in noise (r>0.463–0.684).

Based on the RGDT results 2 groups of listeners were formed: with normal and poor temporal discrimination thresholds. The increase of speech intelligibility with HA in the first group was found to be higher than in the second group ($p<0,05$). Thus the HA efficiency in patients with normal RGDT results was proved to be higher, especially in the background noise.

CONCLUSION: The HA efficiency can be prognosticated on the basis of the binaural fusion test and the RGDT results.

KEYWORDS: Hearing aids, speech intelligibility, random gap detection test

SLOVENIAN EHDI PROGRAMME TENDS TO ASSESS PROGRESS TOWARDS NATIONAL GOALS

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BACKGROUND: Universal newborn hearing screening (UNHS) was introduced in Slovenia in 2005. Infants who do not pass the screening are subjected to audiologic and medical evaluation in order to confirm their hearing loss before three months of age. Toddlers with permanent hearing loss receive necessary services before six months of age. Hearing loss may be seen later in childhood at children with risk factors. So, careful audiologic follow-up is very important.

PURPOSE: To show the real quality of our programme for early hearing identification, diagnosis and intervention (EHDI), and to demonstrate the need for standardized data and reporting for EHDI programme collecting information on UNHS and follow-up in a standardized manner.

MATERIALS and METHODS: We prepared analysis of amplification hearing impaired children with HA since 2006 till 2013. In that period we had 168379 lifeborn infants. 96% of them undergone UNHS. 1.8% of tested infants (or 1.77% of all lifeborn infants) did not pass the test. We identified 418 hearing impaired children (0.25% of all lifeborn infants) who had completed diagnostic follow-up and received HA. 169 (0.10% of all lifeborn infants) of them received CI. 199 infants got HA at the age 1 year or less, 69 children at the age 2-6 years and 122 children at the age 7-18 years.

CONCLUSION: Ensuring that children receive recommended follow-up is challenging. Without complete reporting by audiologists to EHDI programme accurate calculation of performance measures is impossible. Standardization of measures is essential for programme to evaluate how many children receive recommended service.

KEYWORDS: Hearing impairment, screening, follow-up, intervention

PREDICTING HEARING SENSITIVITY IN YOUNG ADULTS WHO USE PERSONAL MUSIC PLAYERS BY SPAR TEST

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OBJECTIVE: During the past decades acoustic reflex threshold (ART) has been used as a clinical tool for the prediction of hearing loss. The implications of the use of Sensitivity Predictions from Acoustic Reflex (SPAR) measures are not used in clinical applications. Jerger and associates have suggested the importance of SPAR in the examination of children. Our use of SPAR with a primarily young adult population has supported other important applications of this procedure, including the use of predictions in noise-induced hearing loss (NIHL) in young adults who use personal music players.

MATERIALS and METHODS: The ability of the sensitivity prediction from acoustic reflex (SPAR) technique to estimate hearing loss in 264 university students was investigated by comparing measured pure-tone thresholds with predicted sensitivity from the SPAR procedure.

RESULTS: The Jerger Method of SPAR test was used in 151 female and 113 male university students. SPAR values of female students are 16.48 for right and 17.25 for left ears and male students are 17.01 right ear and 18.62 left ear respectively.

DISCUSSION: The SPAR may offer a cost-effective method for the early detection of noise- induced hearing loss.

KEYWORDS: Acoustic reflex threshold (ART), sensitivity predictions from acoustic reflex (SPAR), noise- induced hearing loss.

WIDEBAND AURAL ACOUSTIC ABSORBANCE IN NORMAL CHILDREN AND IN CHILDREN WITH OTITIS MEDIA WITH EFFUSION

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INTRODUCTION: Wideband (WB) acoustic absorbance is a new technique for assessing middle ear transfer function.

OBJECTIVE: The aim of the present study was to compare the normative pediatric WB absorbance data with the WB absorbance data obtained from children with abnormal middle ear conditions.

DESIGN: WB absorbance was measured in the ear canal over frequencies from 0.25 to 8 kHz at ambient pressure or as a swept tympanogram. Twelve participants (22 ears) were included in the control group (age range 3.6 to 7.7 years, mean 5.5 years). Subjects in the control group had audiometric air and bone-conduction thresholds <15 dB HL, and air-bone gaps (ABGs)<15 dB HL, oto-acoustic emissions. Thirteen participants (20 ears, age range 3.5 to 9.6 years, mean 5.8 years) were included in the middle ear effusion (MEE) group (10 ears) and negative middle ear pressure group (10 ears). Normative pediatric WB absorbance data were compared with WB absorbance data from children with MEE and negative middle ear pressure.

RESULTS: WB absorbance at ambient pressure (0±8 daPa) was decreased, at all frequencies in MEE group, at low frequencies in negative middle ear group compared to a control group. WB absorbance consistently decreases and decreases over a wider range of frequencies as the middle ear condition changes from negative middle ear pressure to MEE.

CONCLUSION: WB absorbance testing may be used as a clinical diagnostic tool to measure the mechanic properties of the middle ear and also may give more detailed information about otitis media with effusion.

KEYWORDS: Tympanometry, otitis media, wideband aural acoustic absorbance, conductive hearing los

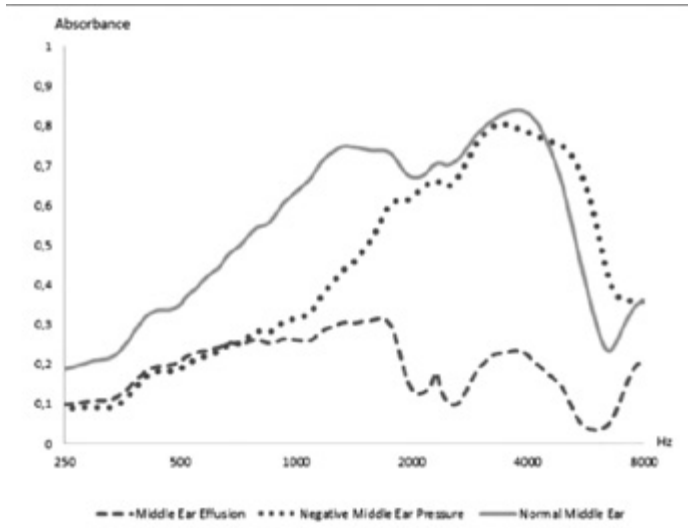

Figure. Wideband absorbance curves of different middle ear condition groups

FUNCTIONING AFTER PEDIATRIC COCHLEAR IMPLANTATION (FAPCI): PRELIMINARY RESULTS OF RELIABILITY AND VALIDITY IN TURKISH

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OBJECTIVE: Effective communication in daily basis with using language and auditory perception skills in children with cochlear implant (CI) are intended by professionals and parents. Lin et al (1) developed FAPCI to evaluate auditory perception performances in everyday life.

The aim of the study is to do the reliability and validity of FAPCI in Turkish.

MATERIALS and METHODS: 30 parents whose children with CI and 30 parents whose children with normal hearing were participated in this study. Children's age were between 1 to 6 years old. In the control group, children with normal hearing were participated to provide normal curve of FAPCI. All participants were randomly chosen among cases who attended and also followed in Hacettepe University Audiology Unit. Normal hearing children were included the study after audiological evaluation.

All participants were filled approval form.

RESULTS: According to the statistical analysis, FAPCI Turkish version is reliable and valid tool to evaluate communication skills of cochlear implanted children. As hypothesized normal hearing children developed communication skills more rapidly. Some early implanted children were reached normal curve after about two years experienced with CI.

CONCLUSION: FAPCI is a reliable and valid tool to evaluate communication skills of cochlear implant user children. It is an effective tool in clinical settings, because of short application time and to inform us about daily life skills of cochlear implanted children.

KEYWORDS: Cochlear implant, pediatric, auditory perception

IS VOICE THERAPY USEFUL IN PATIENTS WITH PROFOUND HEARING LOSS?

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OBJECTIVE: The aim of this study was to evaluate changes in the acoustic features of voice in patients with profound sensorineural hearing loss in order to obtain voice therapy success.

DESIGN: 15 patients between 20 and 25 years of age with prelingual bilateral symmetric profound hearing loss (group A) and 15 postlingually cochlear implanted patients between age 26 – 65 (group B) were included. As a control group (group C) 15 normal hearing adults aged 20-30 years were identified.

SETTING: Prospective analysis.

MATERIALS and METHODS: Voice Handicap Index to quantify the psychosocial consequences of voice disorders and sustained vowels /a/ / was digitally recorded with the Multidimensional Voice Program (Kay Elemetrics) in all subjects.

MAIN OUTCOME MEASURES: The parameters estimated were the average of fundamental frequency (F0), jitter percent (jitter), shimmer, noise to harmonics ratio (NHR), voice turbulence index (VTI), soft phonation index (SPI), PPQ and APQ.

RESULTS: Compared to the cochlear implanted patient group (Group B), in group A, acoustic parameters presented a statistically significant higher value.

CONCLUSION: The study demonstrates that profound hearing loss affects voice production by changing its parameters. Cochlear implant recipients postlingually deaf adults (group B), without specific vocal rehabilitation, differed from nonrecipients (group A) in loudness and F0 variability sustained vowel /a/.

KEYWORDS: Hearing loss, cochlear implants, voice training, voice quality,unintelligible articulation

MIGRAINE AS A RISK FACTOR IN DEVELOPING TINNITUS

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Tinnitus is associated with an increased spontaneous central neural activity, which may result from different pathologies at different levels of the auditory system. The majority patients with tinnitus have associated hearing loss, which could lead to tinnitus. However, at least one third of patients have no measurable hearing loss, raising the question of the cause of tinnitus and the possibility that tinnitus is due to central mechanisms. Following clinical observation that patients with tinnitus and normal hearing are often affected by migraine, the possibility of cortical auditory dysinhibition in these patients was suspected.

A study was conducted to compare transient evoked otoacoustic emission (TEOAEs) in patients with tinnitus and normal hearing (n=45) and control subjects (n=15). A subgroup of patients with tinnitus and migraine (n=12) and normal subjects (n=13) also underwent recording of cortical evoked response; N1-P2 amplitudes were measured following three consecutive blocks of stimuli to assess the process of habituation.

The study showed a 53% prevalence of migraine in patients with tinnitus and normal hearing. TEOAE and N1-P2 amplitudes were greater in patients with tinnitus than in normal control subjects, suggestive of increased auditory gain at cochlear and cortical levels. The comparison of N1-P2 amplitudes following three consecutive blocks of stimuli showed a greater decrease in responses in normal subjects, implying that the process of habituation is affected in tinnitus group.

The above results suggest that migraine is a risk factor in developing tinnitus; cortical disinhibition and impaired process of habituation are likely underlying mechanisms of tinnitus.

KEYWORDS: Tinnitus, migraine, normal hearing

SERVICES FOR CHILDREN WITH TINNITUS - THE UK EXPERIENCE

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OBJECTIVE: To explore the current service provision in the UK for children with tinnitus

MATERIALS and METHODS: The reported service provision is based on the results of 2 surveys about tinnitus in children, the first conducted on members of the British Society of Audiology members and the second by the British Tinnitus Association.

RESULTS: There is a lack of standardised practice for the management of tinnitus in children in the UK. Services for children with tinnitus are sparse with many professionals within audiology feeling that they lack the skills and resources to manage these children.

Few routinely asked children in clinic if they had tinnitus. The factors which influenced the routine questioning of the child included the child's age and communication level, whether tinnitus was the presenting symptom, and the nature of other audiovestibular symptoms. Around three quarters were unhappy with their current level of knowledge and management skills and felt they needed further training. Many respondents felt that they did not have suitable networks currently in place or access to a specialist interested in paediatric tinnitus.

CONCLUSION: There is a need to develop services for children with tinnitus in the UK. Tinnitus in children is a neglected area, from both a clinical and a research perspective. Tinnitus can have a significant effect upon a child's physical and psychological well-being, and educational progress. Services for children with tinnitus need a holistic multidisciplinary approach to able to address the different developmental stages of a child with tinnitus and the varied impact of tinnitus.

KEYWORDS: Tinnitus, children, paediatric, pediatric, service

ASSR AND ABR WITHOUT SEDATION IN PEDIATRIC INDIVIDUALS

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OBJECTIVE: To access the efficacy of ASSR and ABR testing in paediatric patients, without the use of any kind of sedation.

MATERIALS and METHODS: Since February 2011 a group of 184 children were examined. In 29 of them (15.8%) there was a need of performing hearing examination using evoked auditory brainstem responses and/or Auditory Steady State Responses without sedation. This was due to contraindications to administration of chloral hydrate, previous reported side effects and the need to perform the examination without the collaboration of a paediatrician.

RESULTS: The process of sleep was normal in 24/29 (83%) cases and no disturbances were observed. In the rest 5 cases (17%) the examination had to be repeated several days later. The obtained responses from brainstem were not interfered by any artifacts and basic waves were legible and easy for interpretation. Normal results of the ABR examination were obtained in 21/29 (72%) children, while in 7/28 (24%) various degree of hearing loss was detected.

CONCLUSIONS: The results of this study suggested that ABR and/or ASSR examination without sedation can be a reliable alternative and perhaps can be used wider for clinical practice.

KEYWORDS: ABR, ASSR, Sedation

SENSORY-NEURAL HEARING LOSS IN DONNAI-BARROW SYNDROME: CASE REPORT

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Donnai-Barrow Sydrome is an autosomal recessive inheritance condition that affects many parts of the body. The individual has facial dysmorphology, diaphragmatic hernia, abnormal brain development as agenesis of the corpus callosum, sensorineural hearing loss, eye abnormalities, abnormal heart, lungs and other organs.

Donnai-Barrow Sydrome's prevalence is extremely rare. In literatür report two sets of sibs (two male and two female patients) from two unrelated families with identical features to those described by Donnai and Barrow in 1993. Since then four patients by Chassaing et all (2003), a patient who applied cochlear implantation by Bruce et all. (2011) and cochlear implantation in a patient with syndromic deafness by Broomfield et all (2013) have been documented.

In our study, 2 brothers with this syndrome following by Genetic were evaluated. After the ear, nose and throat examination, immittance measurements and pure tone audiometry tests, Otoacoustics emission tests (TEOAE and DPOAE), Auditory Brainstem Response, Cortical Auditory Potentials were applied. Language development was assessed usinn the Preschool Language Scale 4.

KEYWORDS: Donnai-Barrow Syndrome, hearing loss

THE EFFECT OF LENGTH OF COCHLEAR IMPLANT USE ON P1 LATENCY IN CHILDREN

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OBJECTIVES: 1. To use Aided Cortical Assessment (ACA) to monitor auditory maturation. 2. To establish time usually required for P1 latencies to shorten.

MATERIALS and METHODS: This is a prospective, longitudinal study. Nineteen, MED-EL SONATATI100 CI users operated at Turgut Özal University hospital with mean age at first fit of 27 months had cortical responses to speech tokens, /m/, /g/ and /t/, at 55 dB SPL, checked at 7 test intervals within 6 months of switched on. The median number of ACA done for each child was 6. All CI users' audio processor (AP) programs were generated from electrically elicited stapedius reflex threshold measures (eSRT). ACA responses were scored. One point for each stimulus eliciting a P1 and another for a P1 latency within reference range. Median scores at each test interval were calculated.

RESULTS: The median ACA scores of post switch on at 1 week, 1 month, 2 months, 3 months, 4 months and 6 months were respectively 2, 4, 4, 5, 5 and 5.5.

CONCLUSION: CI users fitted using eSRT fitting method usually have P1 responses with shortened latencies, representing access to quiet

conversational speech, with 3 to 6 months of CI use. An early implanted CI users scores enters into the same values with normal hearing child, in 3 to 6 months of CI use. Growth of ACA scores overtime shows ACA can be used to monitor auditory maturation.

RECOMMENDATIONS: Fit using objective eSRT fitting method and monitor auditory maturation using ACA.

KEYWORDS: New cochlear implant users, aided cortical assessment, eSRT

PREPARING COUNSILLING MATERIAL FOR VESTIBULAR REHABILITATION

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Dizziness, vertigo and disequilibrium are common symptoms that may result from a peripheral vestibular disorder. Patients affected by certain symptoms of vestibular disorders may be perceived as anxious, panic, socially isolated and depressive. Patients need comprehensive counseling to cope with these complains. It is necessary to have a consultation with the patients who have vestibular disorders about all aspects of their disorders in order to cope with it more effectively regardless of the kind of treatment applied. The counseling material included both information on the disorder and coping strategies related to vestibular disorders; this information has to be provided in a suitable, understandable and standardized manner in the material. The aim of this study is to develop a visual counseling material about vestibular disorders and treatment strategies.

KEYWORDS: Vestibular rehabilitation, counselling, visual counselling material

BILATERAL SUPERIOR SEMICIRCULAR CANAL DEHISCENCE

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Bilateral superior semicircular canal dehiscence is a challenge for not only the patient but also the surgeon to choose the surgery side. In the literature, there is very few data about this dilemma and they say that VEMP thresholds are lower on the worse or symptomatic side. But in our case, 36 year old male, in c-VEMP P1-N1 waves showed up at 65 dB bilaterally and at 80 dB in o-VEMP bilaterally. But in the audiogram there was almost 20 dB of air-bone gap in the left ear, while almost normal hearing on the right side. So we plugged the dehiscence on the left superior semicircular canal via middle fossa approach. In this case, we discussed this rare entity and presented our patients postoperative results.

KEYWORDS: Superior semicircular canal dehiscence, bilateral, VEMP, surgery

THE EFFECT OF FM SYSTEM ON SCHOOL PERFORMANCE OF PRIMARY SCHOOL STUDENTS WITH COCHLEAR IMPLANTATION: A PRELIMINARY STUDY

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INTRODUCTION: Children with cochlear implant (CI) often experience difficulty on speech-perception in classroom settings due to significant detrimental effects of increased background noise, reverberation time and speaker-listener distance. FM systems are listening assistive devices which improve speech intelligibility by increasing signal to noise ratio of CIs or hearing aids especially in classrooms. To date, a limited number of studies have assessed the efficacy of FM systems for school success of children with CI.

OBJECTIVE: This preliminary study, which is the first study including primary school children, aimes to determine whether there are significant improvements for school success of primary school children with CI who are fitted with FM systems.

DESIGN: Twenty children with CI aged between 6 to 7 years were participated in this study. Children were randomly enrolled into two groups. Group I was children with CI. The children in group II were provided FM system in addition to CI. It was planned to assess improvements of school performance of two groups by developing scales appropriate for fundamental acquisitions of primary school lessons in regular periods of a school year.

RESULTS and CONCLUSION: The children will be evaluated for 3 times during the study; one at baseline, the other in midterm, and the last one at the end of the academic year. The baseline performance was similar between two groups ($p>0.05$). The results of the mid-term and final evaluations indicated the advantages of FM systems in children with CI.

KEYWORDS: FM system, Cochlear implant, Primary school, School performance, Audiology

A SPEECH AUDIOMETRY TEST FOR PRESCHOOL CHILDREN IN THE GREEK LANGUAGE

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OBJECTIVE: Although there are several speech audiometry tests in the Greek language, there is no test available for preschool children.

The aim of this study was the development of a word recognition score test for this age group.

MATERIALS and METHODS: The test is designed in a closed-set format and consists of two lists of fifty disyllabic words in each list. Two syllable words were chosen as stimuli because of the limited number of monosyllabic words in the Greek language. Each disyllable is used in combination with six pictures on a single card. The lists are phonemically balanced with a vocabulary selected from a speech sample of 300 children aged three through six years of age.

RESULTS: Regression analysis of the performance-intensity functions, in forty native preschool children, twenty boys and twenty girls, 48 to 72 months of age, whose hearing was within the normal range, suggests that both lists are generally equivalent for clinical purposes.

CONCLUSION: Overall, the results suggest that this test deserves further testing with different types and degrees of hearing loss and has the potential to become an additional tool for the audiological evaluation of preschool children.

KEYWORDS: Speech audiometry, word recognition test, preschool children

EFFICIENCY OF ASSR AS A HEARING SCREENING TEST IN TERM NEONATES, INFANTS AND YOUNG CHILDREN: A COMPARISON WITH CLICK-ABR

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OBJECTIVE: To investigate the role of ABR (Auditory Brain Stem Response) and ASSR (Auditory Steady State Response) in the diagnosis of sensorineural hearing loss in children.

MATERIALS and METHODS: ASSR and click ABR (auditory brain stem response) were used for the detection of sensorineural hearing loss in sixty five children (ages 1 to 6; mean, 14 months old). ASSR and ABR were performed in all cases and statistical analysis was performed.

RESULTS: Significant correlation was found between the results of click ABR and ASSR in children with sensorineural hearing loss.

CONCLUSION: A significant correlation between the results of ASSR and ABR as a diagnostic method of sensorineural hearing loss inchildren was found. The use of ASSR revealed more information in cases of severe and profound hearing losses. Both techniques should be complementary in the diagnostic approach of hearing problems in pediatric population.

KEYWORDS: ABR, ASSR, hearing screening test

AUDIOLOGICAL EVALUATION OF A 44-MONTH OLD CHILD WITH BURN-MCKEOWN SYNDROME:CASE REPORT

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INTRODUCTION: Burn-McKeown syndrome (BMKS), caused by homozygous or compound heterozygous mutation in the TXNL4A gene (611595) on chromosome 18, is a rare genetic disorder characterized by choanal atresia, hearing loss (HL), cardiac defects and craniofacial dysmorphisms. Here we present audiological assessment of the first Turkish child diagnosed with BMKS.

CASE REPORT: A 44-month old child with BMKS was referred to our clinic for comprehensive audiological evaluation. She had symptoms compatible with BMKS. In addition, she had hallux vagus, fifth finger clinodactyly, imperforate anus, persistent ductus arteriosus and bilateral sensorineural hearing loss (SNHL). In our clinic, she was diagnosed with moderately severe and severe SNHL for left and right ears, respectively using objective and subjective audiological tests. Moreover, Denver Developmental Screening Test II (DDST-II) showed that she achieved developmental milestones at her age norm except a slight language delay. Similar results were also found for language delay in Turkish Recessive and Expressive Language test (TIFALDI). She was bilaterally fitted with behind-the-ear digital hearing aids.

CONCLUSION: Since hearing loss is a frequent symptom in this rare condition, it is a requirement to perform routine audiological assessment in regular periods and if necessary, patients should get involved to aural rehabilitation and family counseling programs.

KEYWORDS: Burn-McKeown syndrome, audiological evaluation, child

THERAPEUTIC APPROACH AND OUTCOME OF EARLY OTOSCLEROSIS IN AIRCREW: CONSEQUENCES ON FLIGHT ABILITY

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Oteosclerosis is uncommon congenital disease whose therapeutic management is controversed in pilot.

OBJECTIVE: Discussing about surgical approach and their impact on flight ability. The authors report a prospective study about 10 cases of osteosclerosis collaged, at the ENT department during 15 years.

RESULTS: The average age was 35years old. It deals with 3military pilots, 04 commercial pilots and 03 mechanics.

Audiogram reveled unilateral hearing loss in 8 cases. CT scan was performed in 8 patients showing early osteosclerosis stage I in one case and stage II in 3cases according to VEILLON classification.

Surgical treatment was not accepted by all pilots (5 refused). Medical treatment based on zymafluor was instituted in one case.

Fighter pilot has been stapedotomy followed by Teflon prostheses interposition. Outcome was favorable; post operative air-bone gap closure was estimated at 90%. He was not conducted as fighter pilot because he was required for administrative responsibilities.

Military transport pilot wish initially refused surgical treatment was followed during 8 years. Last tonal audiometry showed that air conduction and bone conduction thresholds were respectively at -50db and -20db. He was declared able for flight with second full qualified pilot on broad.

Two mechanics agree for surgical treatment. Post operative result showed complete air-bone gap closure. Both mechanics were exempted for aircrew function.

CONCLUSION: In aeronautics, surgical treatment of osteosclerosis can lead to perilymphatic fistula and so to inability for flight. Nowadays, Thanks to surgical progress, osteosclerosis can be operated even in early stapes using rigorous approach.

KEYWORDS: Osteoslerosis, stapedotomy, aircew, ability to flight

REHABILITATIVE OUTCOMES IN DEAF CHILDREN WITH BRAINSTEM HYPOPLASIA-TWO CASES

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AIM: The purpose of the study is to share our experiences with complex cases with bilateral profound hearing loss. The impact of these early life periods (cognitive, language etc.) on child development is essential to predict the improvements of communication skills.

MATERIALS and METHODS: One of cases is twenty-one months old, female patient with bilateral orbital anomaly, bilateral profound sensorineural hearing loss, brainstem hypoplasia and global developmental delay. Hacettepe University Genetic Department hadn't yet identified any known syndrome. Other case is 6 year old, male patient who has bilateral profound sensorineural hearing loss, brainstem hypoplasia, cleft lip and palate and global developmental delay. All cases auditory perception outcomes were evaluated with Ling's Six Sound Test, Meaningful Auditory Integration Scale (MAIS).

RESULTS: First case has been using bilateral hearing aids for two monthts. After bilateral hearing aids use her IT-MAIS scores reached 13/40. Deafblind patients are having difficulty in finding the localization of the sound. Reports from successful cochlear implants in some cases with deafblind have been reported several times in recent years. Other patient uses bilateral hearing aids, but no benefits. MAIS score is 3/40; Ling's sound test recognition score is 0 and he only uses gestures to communicate. He is in the evaluation period for ABI.

CONCLUSION: Deaf children with complex needs are difficult issue in candidacy process and in rehabilitation process. All developmental areas would be reviewed before the CI or ABI surgeries. Multidisciplinary approach is the best way to diagnos and follow these patients.

KEYWORDS: Brainstem hypoplasia, deafblind, auditory perception

ASESSMENT OF SUBJECTIVE UNILATERAL TINNITUS IN ICF FRAMEWORK

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OBJECTIVE: Tinnitus is a common auditory symptom that interferes with activities of daily living. Tinnitus patients often complain psychological problems such as anxiety and depression, sleep disorders, and attention deficit. The aim of this study was to assess acoustic and psychic parameters of subjective tinnitus in the framework of the World Health Organization's International Classification of Functioning, Disability and Health (ICF) and show the most important ICF-based limitations of tinnitus evaluations.

MATERIALS and METHODS: A total of 50 tinnitus patients were conducted Tinnitus Handicap Inventory (THI), Beck Depression Inventory (BDI), and Visual Analogue Scale (VAS). In statistical workup, the open-set responses were categorized by 2 independent researchers using a classification based on ICF. If a subject listed a particular life-effect area, they were given a score of 1. No listing result a score of 0 for that subject for that particular response area.

RESULTS: Mean and standard deviation (SD) of THI scores were 44.28±19.75. Mean and SD of BDI scores were 25.10±12.36. Mean and SD of VAS scores were 5.58±2.12. Significant relationship between THI-BDI, THI-VAS and BDI-VAS were found ($P<0.05$). Significant positive correlations between THI-BDI, THI-VAS and BDI-VAS were determined. ICF based evaluation showed that tinnitus evaluation is multi factorial which depends on body functions and activity limitations.

DISCUSSION: The results support that there is a relationship between tinnitus and depression symptoms. Perceived severity of tinnitus affects the daily life of patients.

KEYWORDS: Tinnitus, depression, visual analogue scale, ICF

TREATMENT OF SUDDEN HEARING LOSS - A COMPARISON OF THE RESULTS OF STANDARD AND SALVAGE THERAPY

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INTRODUCTION: Salvage therapy of Sudden Idiopathic Sensorineural Hearing Loss (SISHL) is a treatment possibility after failure of standard therapy. The paper aims to compare the treatment effect of initial steroid therapy (ST group) and salvage therapy by means of rheohaemapheresis (RF group) or intratympanal steroid therapy with MicroWick system (MW group).

PATIENTS and METHODS: In the years 2012 – 2014, 88 patients were treated by means of conventional ST for SISHL. Of these, 42 patients underwent salvage therapy using RF (n = 27) and MW (n = 15). All three groups were evaluated one month after therapy termination. The criteria were dB (WHO rating) and Fowler's calculation, the therapy effect was evaluated according to the AAOHNS rating.

RESULTS: The initial ST led in 5 patients (12%) to complete hearing improvement. Further improvement was achieved after RF (n = 16; 67%) and MW (n = 5; 39%). Worsening of hearing was observed at equal number (n = 5; 39%) after MW, compared with none after RF. In average, the improvement was achieved by 9 dB (16% Fowler) after sole ST, further 0.2 dB (1% Fowler) after salvage MW and 19 dB (17% Fowler) after RF.

CONCLUSION: In failure of conventional ST, salvage therapy options still exist. At our patients, the RF following failed ST provided significant improvement of hearing for most treated patients, and showed a significantly higher effect upon an alternative MW system.

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KEYWORDS: Sudden hearing loss (SISHL), salvage therapy, rheohaemapheresis, intratympanal steroid therapy

ACOUSTIC ANALYSIS OF TEACHERS WITH EXPERIENCE OF 5 OR MORE YEARS OF TEACHING

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OBJECTIVE: Teachers are excessive voice users for their profession. The voice of elementary school teachers who are experienced 5 or more years were assessed by the acoustic analysis.

MATERIALS and METHODS: 43 teachers (8 male, 35 female) from 3 elementary school, experienced 5 or more years (5-42 years; mean 14,12 years ± 11,45), attended. Acoustic data were collected and assessed using Dr Speech (Seattle, WA, USA) and Vocal Assessment programme. The correlation between the acoustic data and sociodemographic data were evaluated with Pearson correlation analysis.

RESULTS: We saw that mean f0 have not changed (r: -0,077) by the years of experience. But also midlevel significantly decrease in Normalized Noise Energy (NNE) (r: -0,438), increase in Signal to Noise Ratio (SNR) (r: 0,43), decrease in breathy voice (r: -0,453) by the years of the experience of teachers. Weak correlation between the years of work and decrease in shimmer (r: -0,338), increase in Harmonic to Noise Ratio (HNR) (r: 0,369) was observed. Almost half of the teachers use amplification in the classroom, this haven't changed acoustic parameters.

CONCLUSION: In our study the experienced teachers had better acoustic parameters than the less experienced. By the years and experience, teachers appear to have better control on their vocal organs.

KEYWORDS: Teachers, voice analysis, teaching experience, voice amplification

COMPARISON OF CALORIC RESPONSES BETWEEN UNILATERAL HEARING LOSS AND NORMAL HEARING SUBJECTS: A PRELIMINARY STUDY

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AIM: The aim of this study was to compare the caloric test results of patients with unilateral hearing loss (UHL) and normal hearing people.

MATERIALS and METHODS: 10 patients with unilateral sensorineural hearing loss with pure tone hearing thresholds over 25 dB HL were included in this study (UHL Group). 10 normal hearing people were considered as control group. Radiologic evaluation was made with CT/MR in UHL patients. Both of the groups were evaluated with pure tone audiometry, speech audiometry and impedance audiometry. Romberg, Tandem Romberg tests, head thrust, head shaking tests, dysmetria, dysdiadochokinesia, spontaneous nystagmus tests were performed in all subjects. Dizziness Handicap Inventory (DHI) and bithermal air caloric test were appllied for both groups.

RESULTS: Mean age of the UHL group was 35.00±6.73 and 28.30±5.63 in the control group. 70% of UHL group was female and fifty percent of control group was male. In comparison to control group, UHL group showed statistically significant difference by means of canal paresis and directional preponderance scores ($p<0,05$). Also the difference between two groups were statistically significant according to DHI emotional, physical, funcitonal and total scores ($p<.05$).

CONCLUSION: Some UHL patients showed significiant canal paresis and directional preponderance. DHI scores were significantly higher in patients with UHL than the normal subjects.

KEYWORDS: Caloric testing, canal paresis, unilateral hearing loss, dizziness handicap inventory

AUDITORY BEHAVIOR ON MINOR HEARING IMPAIRMENT IN READING ACQUISITION AGE

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INTRODUCTION: The reading acquisition made with a permanent or fluctuating minor hypoacusis in one or both ears means more work for attention and greater fatigue than in children with a clear hearing because the audibility is compromised. This decrease in audibility can impact the child's auditory behavior. The Children's Auditory Processing Performance Scale (CHAPPS) is a scale developed to identify and quantify the auditory behavior.

AIMS: To determine whether there are differences in the auditory behavior of children with and without minor hypoacusis at the end of 1st grade.

MATERIALS and METHODS: It was requested to teachers of 22 children with minor hypoacusis and of 22 normal hearing children, to fill CHAPPS. The number of children with and without hypoacusis was equal to each teacher. Teachers had no knowledge about their students hearing assessment. RESULTS: There were statistically significant differences between the two groups in the total CHAPPS, and in the listening situation subscales: silence, noise, ideal, multiple stimuli and auditory memory, with the worst performance by children with minor hypoacusis.

CONCLUSION: Children with minor hypoacusis when compared to children without minor hypoacusis, same age and similar socio-cultural environment, has worse auditory behavior and worse auditory memory performance both in a quiet room as a room with background noise, or even when they are face to face without distractions and with good eye contact. We conclude that the quality of the auditory skills during the acquisition of reading, which is a distinct auditory key, is altered in children with minor hypoacusis.

KEYWORDS: Minor hearing loss, CHAPPS, auditory behavior, reading acquisition

CHRONIC NASAL OBSTRUCTION IS A RISK FOR CONDUCTIVE TYPE HEARING LOSS IN THE CHILDREN REFERRED TO AUDIOLOGY DEPARTMENTS

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AIM: Hearing loss (HL) is very common in early childhood. Although temporary conductive type HL caused by otitis media with effusion (OME) are more common, permanent sensorineural HL is of major importance for audiologist's view. OME is mainly related with upper airway infections and/or chronic nasal obstruction (CNO) during early childhood. Our purpose in this study is to look for whether presence of mouth breathing, snoring and apnoea in history of the children referred to audiology departments could be an indicator of HL or its type.

MATERIALS and METHODS: All children tested in audiology department in 2014 were retrospectively evaluated and all subjects in which history of mouth breathing, snoring and apnoea were detected were included to the study. Presence of these symptoms was scored as follows; never: 0, sometimes: 1, often: 2, always: 3. Then clinical nasal obstruction score (CNOS) was calculated as sum of those values.

RESULTS: Data of 137 children were retrospectively evaluated, and found that 56 (40.86%) of them had HL in one or two ears (sensorineural: 11, conductive: 37, mixed: 2). Chi-square analysis disclosed that conductive-type HL was more often in the subjects suffering from mouth breathing, snoring or apnoea (36.14%, $p=0.004$; 38.81, $p<0.006$; 52.28, $p<0.02$). CNOS of the children with conductive type HL was significantly higher ($p< 0.01$). No statistically significant data was found for all children with HL.

CONCLUSION: Presence of either one or all symptoms of CNO is a good indicator for conductive type HL in the children referred to the audiology departments.

KEYWORDS: Paediatric audiology, conductive type hearing loss, apnoea, mouth breathing, snoring

DESIGNING A NEW AUDIOMETER DEVICE

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The purpose of this study is to design a new general-purpose audiometer device. Basically, basic function of audiometer is to generate test tones with different frequencies and levels that are generated by an oscillator and controlled by a microcontroller, and then to transfer results to the computer monitor via serial communication port. In this study, an audiometer device is designed to conduct both pure-tone and screening tests. In addition, the device has an automatic test option to conduct the predefined tests in an order. All these functions of the audiometer can be selected via either on-board buttons or the computer. The obtained results can be seen on the computer monitor and by the audiometer screen itself. The proposed audiometer cannot be used in clinics, of course, but it can be used in both educational and research purposes. In addition, it can be developed easily for other purposes.

KEYWORDS: Audiometry, hearing test, hear loss

CONTRALATERAL SUPRESSION OF TRANSIENT OTOACOUSTIC EMISSIONS IN CHILDREN WITH SPEECH-SOUND DISORDERS

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OBJECTIVE: The aim of this study was to investigate the auditory system functions of the olivocochlear efferents in children who have speech-sound problems.

MATERIALS and METHODS: Twenty two children (n: 44 ears) who have problems in the production of speech sounds (Mean age±SD, 6.8±3.2) years participated the study. After obtaining approval of local ethical committee and informed consents, all participants underwent otoscopic examination, audiometry (between 1 kHz and 4 kHz), Transient Evoked Otoacoustic Emissions and Transient Evoked Otoacoustic Emissions with contralateral supression. All participants had a hearing threshold of 20 dB HL by audiometry test.

RESULTS: There was statistically significant difference between TEOAE and TEOAE with contralateral supression test results (1 kHz and 4 kHz) of children with speech-sound problems ($p<0.05$).

CONCLUSION: As a result, it was found that the decrease of the contralateral supression values of the children with speech-sound disorders. According to these findings, we thought that there was delayed auditory feedback in olivocochlear efferents system.

KEYWORDS: Speech-sound disorder, phonological problems, auditory efferents, hearing, otoacoustic emissions

DOES USE OF INDIVIDUAL ACOUSTICAL TRANSFORMS IN HEARING AIDS HAVE THE POTENTIAL TO IMPROVE THE PERCEIVED SOUND QUALITY?

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Ideally, a hearing aid should pick up and amplify the sound, which is present just in front of the ear drum in the open ear. This would enable a well-defined insertion gain to be obtained, as prescribed by a given fitting rationale. In reality, the hearing aid picks up the sound at another location, its physical presence obstructs the ear canal, and furthermore, the hearing-aid gain is specified in a coupler and not in the individual ear. These issues are normally compensated for by including various acoustical transforms (ATs) in the prescription of the hearing-aid gain. Even though large individual variations in ATs are known to exist, the applied ATs are typically standardized values. The aim of this study was to investigate whether use of individual rather than standardized ATs has the potential to improve the perceived sound quality of hearing aids. The study included 18 normal-hearing participants. The sound quality corresponding to five different frequency responses was assessed in a paired-comparison test design. The frequency responses represented various degrees of AT individualization, ranging from no individualization (use of standardized ATs) to full individualization (based on individual measurements performed as accurately as possible). Stimuli were five different sound samples, presented via insert earphones. The results indicated that use of individualized ATs has the potential to offer a significant improvement in perceived sound quality. However, low-resolution (smoothed) rather than spectrally detailed versions of the individual ATs were generally preferred. Furthermore, a notable individual variation in the preference pattern was observed.

KEYWORDS: Hearing aids, acoustical transforms, sound quality

PRIMARY AUDITORY NEUROPATHY: A CASE REPORT

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INTRODUCTION: Auditory neuropathy is a specific and infrequently seen hearing disorder characterized by the preservation of outer hair cell function despite the absence of auditory brainstem evoked responses. We want to present a patient with auditory neuropathy.

CASE: A seventeen years old female patient admitted to our clinic with a complaint of hearing loss existed for two years. An ear aid was proposed previously by another ENT clinic, but she said that she did not benefit from the ear aid although she used it nearly 6 months. Audiometry test was performed and bilateral moderate sensorineural hearing loss was present in patient (Right ear:65db, left ear:60db). DPOAE and TEOAE responds were received in both ears, however synchronized waves were not seen in ABR. There was no pathological findings in temporal and cranial MRI. The patient was diagnosed with auditory neuropathy according to these findings. We didn't implement ear aid but we only suggested auditory rehabilitation.

CONCLUSION: Auditory neuropathy is a significant and rarely seen hearing disorder. The exact site of the pathological lesion in auditory neuropathy hasn't been demonstrated, yet. ENT doctors should keep in mind the clinical features of this disease in order not to overlook the disease. Because underdiagnosis or inappropriate treatment of the disease may worsen hearing loss and also may negatively effect the psychosocial development of the patient. We aimed to review the clinical features, audiometric findings, psychopathologic and treatment approaches to patients with auditory neuropathy.

KEYWORDS: Auditory neuropathy, outer hair cell, hearing disorder