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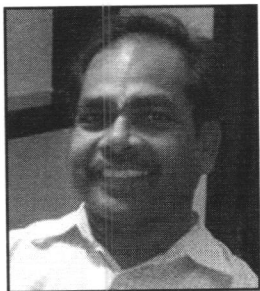
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Editorial



The ISAM Journal is published to provide a platform to the Indian intellectuals indulging in research in Audio-Vestibular disorders. This year 62 articles have been accepted for inclusion in the 3rd volume of ISAM Journal. Long colonial rule has created sense of inferiority complex in the minds of Indians. Daring to assert an unprecedented stand on science and technology or innovate solutions to the problems afflicting Indian community is not witnessed among Indian researchers. Much of the work continues to be confirmation/ revalidation of work done elsewhere with certain variations of sampling, influencing factors or variables. Although Indian researchers still remain jittery about the possibility of re-inventing the wheel, there is some silvery lining to the dark cloud of imitating multitudes.

The ISAM Journal which will be the mouthpiece of International Society for Audiological Medicines will continue to provide a hope to the young researchers for publication of their hard work & findings whatsoever. The fear of mediocre performance must not deter the initiatives of institutive minds. It is certain that continuation of these efforts will lead them to some windfall or amazing discoveries.

The Institute of Health Sciences started its operation in 1999 in the state of Odisha that was best known for its poverty, natural calamities, administrative inertia and is perceived as entrepreneurial graveyard. But Institute of Health Sciences has positioned itself as the solution provider to the need of the local community and has made itself the pioneer of Rehabilitation Services in many ways. By hosting the ISAM and publishing the ISAM Journal, Institute of Health Sciences has made itself relevant to the entire professional fraternity of Audiology-Otolaryngology in India.

ISAM Journal has been continuously linked to the event International Symposium on Audiological Medicine. In future, the publication should evolve to sustain on its own as a peer reviewed professional Journal.

Greetings to all the Authors/ Researchers whose work is published in ISAM Journal, Volume-3, and greetings to all the professionals who would utilize this Journal!

Chief Editor

Prof. Satya Mahapatra

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Use of Chirp as alternate stimuli for Otoacoustic emission measurement

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Introduction: Otoacoustic emissions (OAEs) are one of the most useful objective tests of hearing, especially in newborn hearing screening. However, ambient noise in the environment is one of the serious concerns, as it adversely affects the OAE recording, thereby reducing the amplitude. Studies on Auditory brainstem response reported that use of alternate stimuli such as broadband chirp elicit greater amplitude and better response than conventional click stimuli. Hence, the current study attempt to compare the OAEs elicited by clicks and chirps stimuli in individual with normal hearing.

Method: A total of 10 participants with the age range of 18 – 25 years were subjected to Transient evoked Otoacoustic emission (TEOAE) recording (Mimosa Acoustics) using Click and Shera Chirp stimuli at the intensity of 47 dB RMS level. All the participants were having normal hearing sensitivity with no other otological and or neurological symptoms. TEOAEs were recorded twice using both the stimulus in either of the ear for five frequencies between 1000 and 5000 Hz. Average signal-to-Noise ratio (SNR) value was calculated and subjected to analysis.

Results & Discussion: Results indicated that TEOAE using Shera chirp and Click produced similar SNR values across frequencies that were recorded. Both the stimuli evoked similar response levels and SNRs of TEOAE. The overall mean response levels for Shera chirp and Click were 11.06 dB and 11.73 dB. Paired sample t-test indicated significant correlation between the two at $p < 0.05$ level of significance.

Studies have shown that Chirp is considered to be alternate stimuli in evoking auditory brainstem response with greater amplitude as it contains greater energy (Neumann, Uppen, kamp & Kollmeier, 1994). However, present study showed no significant difference between the two stimuli. Jedrzejczak et al. (2012) also supported the present findings and recommended to use chirp as alternate stimuli to click. .

Conclusion: The results indicated no significant difference between the sherra chirp and click stimulus recorded at the same level. Hence, the type of stimuli, either click or chirp, can be used for eliciting OAEs. However, ambient noise should be considered while recording OAE to avoid increase of referral rates and misinterpretations.

Key word: TEOAE, Chirp, Click, Signal-to-Noise ratio (SNR)

Smart phone hearing applications: A boon or bane to identify hearing loss?

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Introduction: With the surge of smart-phone popularity in the recent years, many individuals have fast and convenient access to health information. Because of its ease, many mobile applications related to healthcare have been developed to monitor individual's health status and it act as a platform for delivery of health assessment and interventions. Even though many android applications are available in the market currently for detecting hearing loss, the accuracy of such apps are often questionable. The present study attempts to estimate the accuracy of the hearing loss detection using android Smartphone applications.

Method: A total of 40 ears with normal hearing sensitivity and a negative history of any otological and or neurological symptoms within the age range of 18 to 30 years were recruited. All the participants had undergone hearing testing in sound proof room using calibrated audiometer and Immitance meter. The android applications that are freely available for hearing screening which included Ear tone and Hearing test assessment were selected for the study. The hearing threshold between 500 Hz and 4000 Hz octaves was estimated using the android applications (Motorola Model Moto G X1032) with its own standard earphone provided by the company. The ear was considered as 'refer', if any of the frequencies threshold fall outside intensity of 25 dB HL.

Results & Discussion: Results indicated that the android applications showed variability in determining hearing screening results. The pass rate (<25 dB) for Hearing assessment test and Ear tone app were 100% and 20% respectively. Previous studies on automated audiometry also indicated valid and reliable results with high variability (Swanepoel et al, 2010; Margolis et al, 2010, 2011; Margolis & Moore, 2011). Possibilities in variation could be due to usage of non-clinical transducer i.e. earphones, environmental conditions, and the understandability of instructions.

Conclusion: Even though many hearing tests apps are available for free of cost, one cannot be completely dependent on android applications for hearing screening in decision making, as they may have limitations in their accuracy. Use of such reports for the purpose of identification of hearing loss needs cautious attention as they may underestimate or overestimate the results due to various factors.

Key word: Smartphone, Android Applications, Hearing loss, Screening, Audiometry

Immediate effects of melody and rock music on distortion product otoacoustic emission (DPOAE) measurements

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Introduction: Recent years, portable music players become more common, especially among youngsters. Several literature reports that the effects of music on hearing is profoundly depend on intensity, duration and the type of music. However, problem on listening to various kinds of music and its potential impact on the auditory system remains questionable. Hence, the present study attempts to investigate immediate threshold (SNR) shift, by means of distortion product otoacoustic emissions (DPOAEs), while listening to melody and rock music on a music player.

Method: Ten participants with the age range of 18-25 years having normal hearing were exposed to rock & melodic music at $\frac{3}{4}$ th of the total volume. Selected participants were the daily listeners of music for not less than an hour. DPOAEs were measured between 1KHz and 8KHz, prior to and after listening to music using Smartphone for a period of 30 minutes. A gap of 2 hours was provided between the two music as rest period.

Results & Discussion: Results indicated a significant difference between pre and post listening conditions for both the melody and rock music across the frequencies. The overall mean difference of SNR between pre and post conditions of melody and rock music were 2.97 dB and 3.52dB. Immediate threshold (SNR) shift was greater for rock music than melody music at the significant level of $p < 0.05$. Studies reported significant reduction in amplitude following music exposure (Bhagat et al. 2008; Jennifer et al. 2012) which might be due to various factors such as listening hours, duration of listening and type of music being listened (Mori,1985). Fast beats could possibly lead to faster adaptation and irregular blood flow in cochlea, thereby damaging the hair cells and increase in temporary threshold shift.

Conclusion: These results suggest that exposure to music at high levels alter the cochlear function. The type of music, which the listener is listening to, also makes significant variations on cochlear functioning. Music listeners should be cautious while listening to music and it highly recommended lowering the volume and lessening the duration for rock type of music than the preferred and recommended volume and duration for melodious.

Keywords: DPOAE, Music Exposure, Temporary Threshold Shift, Hearing Loss, Rock Music, Melody Music

Auditory perceptual skills in children with partial and total visual impairment

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Introduction: Auditory skills in visually impaired individuals are noted to be strongly evolved compared to sighted counterparts. The lack of ability to perceive visual stimuli may lead visually impaired individuals to adapt and develop other residual auditory or tactile sensory abilities, which has an important role in social growth. The study aims to investigate the auditory perception skills in with and without visual impairment (partial and total). Objectives were to compare auditory memory, speech in noise perception and also lateralization abilities between those with and without visual impairment.

Method: A total of 48 children participated in the study. These children formed three groups; 16 sighted children, 16 children with partial and 16 total visual impairment. Each group consisted of equal number of younger (6 to 12 years) and older children (13 to 16 years). For all children detailed case history, ENT and audiology screening was done. For younger groups, 3 auditory tests were administered; auditory memory tests (forward and backward digit span tests), syllable identification test (quiet and noise) and auditory lateralization test (0 degree, 180 degree, right-90 degree, left-90 degree azimuth) test. For older children groups auditory memory tests (ascending and backward span test), QuickSIN sentences and auditory lateralization test (Six positions – 0 degree, 180 degree, right 90 degree, right-45 degree, left-45 degree, and left-90 degree) were administered. Stimuli for all these tests were presented using paradigm software (version 2.5.0) at comfortable level through calibrated Sennheiser HD449 headphones routed via Dell laptop. Familiarity of the test was done.

Results: Using SPSS software, based on Shapiro-Wilk test non-parametric statistical analysis was carried out. Kruskal-Wallis test revealed in all three younger groups, significant difference was noted in auditory lateralization test (Position-R90f~). However, difference was not observed in memory tests and syllable identification test. In older group, significant difference was noted in both memory tests and auditory lateralization test (Position-L90 f~) but not in QuickSIN test. Pair-wise comparison using Mann-Whitney U test revealed significant better performance by children with total visual impairment compared to sighted children in younger group in localization test. Also in older group, sighted children had poorer performance than children with partial visual impairment in memory test.

Discussion and conclusion: Above result might hint the existence of fine-tuned auditory system. It is noted that in younger children, differences were not found between sighted and visually impaired children might be due to lack of sufficient auditory experience inducing changes in abundant neural territory. The ability to perceive speech in noise was found to be equal in both groups and in both the age ranges. This might be due to the fact that, in visually impaired children sensory receptors in brainstem have not undergone sufficient adaptation to show differences. Also, it might be possible that compensatory changes that blindness is inducing are different at cortical and sub-cortical level.

Key words: Visual impairment, auditory perceptual skills, Auditory Localization, Speech perception, auditory memory.

Binaural interaction component for frequency following response using speech stimulus

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Introduction: The measurement of the binaural interaction component (BIC) of the auditory brainstem response (ABR) can be used to record the functioning of binaural neural processes (Wong, 2002). The study would provide normative data for BIC using frequency following response (FFR) for speech which is limited in the literature. In addition, the results of the study would also help in determining the optimum stimuli for BIC that could be used in clinical population. The aim of the study is to determine binaural interaction component for frequency following response using speech stimulus in young adults with normal hearing.

Method: The study was carried out on 24 participants (12 males & 12 females) in the age range of 18-25 years with normal hearing sensitivity. BIC was calculated from monaurally and binaurally recorded ABR for speech stimulus /da/ with 40 ms duration at 80 dBnHL with standard stimulus and response parameters (Skoe & Kraus, 2010).

Results: The results of the study showed that binaural interaction component was present for FFR using speech. The BICs obtained at the peaks of D, E, F, O of Speech evoked ABR were highest and significantly higher ($p < 0.001$) compared to all the other BICs obtained in the study based on Wilcoxin's signed rank tests. Mann Whitney U test showed that there was no significant difference ($p > 0.05$) across gender for amplitude and latency of BIC.

Discussion: The amplitude of BIC recorded for FFR using speech stimuli were larger compared to BIC recorded for clicks and tone bursts (Fowler & Horn, 2012; Van Yper et al. 2015). The amplitude of the BIC obtained are in consensus with the other study on BIC using speech evoked ABR by D'costa et al. (2010). However, larger number of BIC peaks was observed at the slope of all the FFR peaks in the present study which is unique compared to other studies.

Conclusions: BIC was seen at all the peaks of FFR for speech stimulus with higher amplitude at later peaks. However, further studies on BIC using FFR on normal hearing children and clinical population are essential for better validation of the results.

Key Words: Frequency following response, binaural interaction, peaks, monaural, binaural

Effect of ageing on cortical encoding of acoustic change within an ongoing stimulus

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Introduction: Acoustic change complex (ACC) is a cortical auditory evoked potentials (CAEP) evoked by time-varying acoustic change/s contained within the stimulus, yields multiple overlapping N1 – P2 complexes. Studies have shown the benefits of recording ACC to quantify the neuromaturation of complex speech signal. But there is dearth of literature in systematically studying the ACC responses across age groups.

Aim of the Study: The present study was carried out to investigate the changes due to ageing on Acoustic Change Complex for naturally produced /sa/ and /si/ syllables.

Method: Cortical potentials were recorded for consonant-vowel syllables /sa/ and /si/. A total of 120 individuals between the ages of 7- 65years with normal hearing sensitivity participated in the study. Subjects were divided into eight groups based on the age. Responses were analyzed for the presence of peaks P1, N1, P2, N1', P2'. Absolute latencies and peak-to-peak amplitude was also measured.

Results and Discussion: Results revealed that the absolute latencies of all the peaks were prolonged for participants between 7 – 16 years in comparison with the latencies of other higher age groups. There was no definite trend observed for amplitudes of N1-P2 and N1'-P2' indicating no maturational variation with age.

Conclusion: ACC can be elicited by naturally produced speech sounds and can be easily recorded across different age groups. This CAEP has potential application to study the neural processing of different acoustic aspects of speech.

Key words: ACC, Cortical auditory evoked potential, Ageing, Maturation

Self-rating of spatial hearing and speech perception in noise in elderly individuals with monaural and binaural amplification

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Introduction: Difficult in understanding speech in presence of background noise is the most common complaint of individuals with hearing impairment. One possible cause for this difficulty is reduced spatial hearing abilities. Several questionnaires are available to assess hearing aid benefit and general hearing problems; only few questionnaires address the issue of spatial hearing abilities.

Aim of the study: The aim of the present study was to document the performance of normal hearing individuals and unilateral and bilateral hearing aid users using spatial hearing questionnaire and to correlate with speech in noise measures.

Method: Four groups of participants were involved in the study. Group I and II comprised of twenty younger and twenty older adults with normal hearing respectively. Group III and IV encompass fifteen older adults with bilateral mild to moderate sensorineural hearing impairment using unilateral and bilateral hearing aids respectively. The spatial hearing questionnaire (SHQ) was administered on all the study participants, who were also tested speech in noise test to obtain SNR-50.

Result: Significant differences were observed across all groups with Group I exhibited good spatial hearing scores across all 8 subscales of SHQ followed by Group II, Group IV and Group III. Significant difference between groups was found for SNR-50 scores except for group II and group IV. The results also showed that there was a strong, positive correlation between SNR-50 score and each SHQ sub-group score in all the groups.

Discussion: The results indicated that older adults also had problems in spatial listening even with normal peripheral hearing. Older adults with unilateral and bilateral aids had extreme difficulty hearing in presence of noise. Good correlation between speech in noise measures and SHQ scores suggests deficit in spatial hearing as one of the probable causes for poor performance in presence of noise in hearing impaired individuals.

Conclusion: Aging and hearing loss affects spatial hearing abilities. Bilateral hearing aids assists in spatial hearing in comparison to unilateral hearing aid. The results also warrant for a different hearing aid fitting protocol for the elderly individuals with spatial hearing deficits into consideration.

Key words: Spatial Hearing, SHQ, SNR-50, Older adults, Hearing aids

Effect of different Cochlear Implant strategies on Music appreciation in Simulated Cochlear Implant

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Introduction: The cochlear implant (CI) strategies converts the acoustic fundamental frequency to electric repetition rate, the second fundamental frequency to electrode position and the acoustic amplitude to current level. Reynon et.al (2003) conducted a study wherein he compared different speech coding strategies using a disability based inventory and speech perception tests in quiet and noise situations. The result indicated that most subjects preferred the use of ACE strategy. However, there is a dearth of such studies in Indian classical / popular music. Hence the present study is an attempt aimed at assessing music appreciation skills when the music signal is processed by the CI unit.

Method: Twenty normal hearing subjects in the age range of 18-22 years were selected for the study. All the participants filled out a questionnaire regarding their musical background. The music selected were all instrumental music played by a trained musician. Speech processing strategies used in the simulation study were CIS and ACE. The task of the subject was to identify the musical note played, the instrument being played, place the sounds in the correct order of notes. The effect of speech processing strategy on music appreciation if any would be studied in this way.

Results: Performances on music perception tasks were better for ACE than CIS strategy. These results are consistent with the theory that better representation of both temporal and place cues for pitch produces better melody recognition.

Discussion: CI processing strategies are severely limited when music perception is considered. Musical note perception and appreciation is also related to reproduction of fundamental frequency and harmonics in the electrical signal. An easier way to study this is to simulate the processing and check the response of the normal hearing subjects. This reduces variability in responses and better control on subject factors like age, effect of training, education and such concomitant factors.

Conclusion: The present study tends to support the view that representation of temporal and spectral cues are important for music perception. Extent of variability and enumeration of differences & limitations needs to be studied in future. The research design seems a viable option and a valid tool.

Auditory working memory deficits in adults who stutter

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Introduction: Empirical evidences show that adults with stuttering (AWS) exhibit longer reading times and poor non-word recognition, which has been used to evaluate working memory abilities. But performance on these tasks tends to be affected by the underlying language disturbances seen in AWS. Moreover, these tasks encompass memory span measures which share complex range of processes. N-back test would allow us to assess exact neural networks involving working memory ruling out the language effects, which has not been studied previously in the literature. Thus, there is a need to study working memory using auditory n-back task which might have implications to the sensory-motor deficits found in AWS. Hence, the aim of the present study to assess auditory working memory using auditory n-back task in adults who stutter.

Method: Participants included seven adults who stutter (AWS) in the age range of 18 - 26 years, and seven age, gender, and language matched adults who do not stutter (AWNS). The participants were subjected to auditory 1-back and 2-back tests using six monosyllables which would increase in the level of cognitive load. A total of 120 syllables which included 30 target n-backs were presented and the reaction time (RT), accuracy, false alarm rate (FAR), and d prime (d') were calculated for each participant in each n-back condition.

Results: Results revealed significant difference between two groups during 2-back task. The d' was significantly different between AWS and AWNS in 2-back task. This was reflected by significantly greater FAR in AWS compared to AWNS and greater accuracy seen in AWNS.

Discussion: The AWS performed equally well with AWNS when it was 1-back task but performed poorly when it was 2-back task, which was more cognitively taxing. This difference in d' can be attributed to the more number of false alarms seen in AWS, which might have resulted because of the anxiety in responding, compensating on the attentional demands, which is in turn reflected as working memory deficits during the difficult task.

Conclusion: Present results provide preliminary evidence for auditory working memory deficits in persons who stutter.

Effect of dialectal variation in speech audiometry

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Introduction: Speech audiometry is a routinely carried out complimentary hearing evaluation procedure with pure tone audiometry which is very crucial for auditory rehabilitation. The aim of the present study was to determine the effect of dialectal variation in speech recognition threshold.

Method: 20 normal hearing native Malayalam speakers within the age range of 18 to 21 years without any significant speech language and hearing related problems. Both males and females between with hearing threshold under the range -10 to 25 dBSL were selected for the research. Subjects with middle ear pathology as well as upper respiratory tract infections were excluded from the study. SRT were performed on 20 normal hearing native Malayalam speakers using Malayalam spondees presented by three audiologists with different dialects .i.e. Hindi, Malayalam and Kannada respectively. Spondees were presented by the audiologists through microphone connected to the GSI 61 audiometers and were received by the subject via headphones (TDH-49). The subject was instructed to sit comfortably and repeat the words heard through the headphones.

Result: Highly significant differences (p value< 0.001) were observed in the results when comparing SRT results of Malayalam dialect with Hindi as well as Kannada dialects. There was no significant difference between the SRT results of Hindi and Kannada dialects. And also there was no significant difference between the results based on gender as well as ear.

Discussion: The results clearly showed that dialectal variations can influence speech audiometric results

Conclusion: Speech audiometry plays a crucial role in the auditory rehabilitation field. The nature of stimuli should be carefully assigned by the audiologists. Usage of prerecorded stimuli can be applied in order to reduce the errors produced by dialectal variations.

Keywords: Speech audiometry, dialectal variation, spondees, speech recognition threshold

Polycystic ovarian syndrome mediated changes in audiological indices

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Introduction: A particularly pervasive endocrine disorders affecting women as young as in the peri-pubertal age is Polycystic Ovary Syndrome (PCOS). In the Indian subcontinent, the prevalence has been noted to be 24% based on Rotterdam criteria and 12.7% by Androgen Excess Society criteria. PCOS is a chronic pro-inflammatory state, which amongst other reproductive and metabolic dysfunction results in endothelial dysfunction. Principle features of the condition are insulin resistance and a heterogeneous excess in androgen concentration which predisposes such individuals to insulin resistance leading to type 2 diabetes, hypertension, sleep apnea, mood disorders, endometrial cancer, obesity, and nonalcoholic steato-hepatitis, elevated serum C-Reactive Protein level. While there exists abundant reports on the effect of PCOS on other subsystems, documentation of its effect on hearing are few. The early onset of PCOS necessitates estimation of hormone mediated change in hearing levels.

Methods: 15 subjects (30 ears) with PCOS and 15 subjects (30 ears) with normal menstrual cycles, in the age range of 18-27 years underwent the following assessment procedures- Conventional Audiometry (CA-250Hz to 2 kHz), High Frequency Audiometry (HFA- 4 kHz, 8 kHz), Extended High Frequency Audiometry (EHFA-9 kHz to 20 kHz), Distortion product otoacoustic emissions (DPOAE) & Transient evoked otoacoustic emissions (TEOAE). The range of frequencies tested in DPOAE were 2KHz to 12KHz. TEOAE frequencies assessed were 700Hz to 4KHz.

Results and Discussion: Statistical analysis revealed that individuals with PCOS had statistically poorer amplitude and sound to noise ratio (SNR) across 4, 8KHz on DPOAE; and at 700Hz on TEOAE. Similarly, statistically significant difference was obtained in the thresholds at 4KHz on HFA and across the frequencies 9KHz, 10KHz, 11.2KHz, and 12.5 KHz in the PCOS group compared to normal group.

Conclusion: The audiological results suggest that HFA and EHFA are more sensitive towards detecting subclinical losses and can serve as early indicators of hearing loss in women with PCOS. Additionally, high frequencies on DPOAE showed significantly poorer SNR. The increased sensitivity of high frequency and extended high frequencies can be attributed to findings that those regions on the basilar membrane are more prone to vascular damage that are evident in hyperandrogenism, insulin resistance, and elevated serum CRP levels.

Keywords: Extended high frequency audiometry, Polycystic Ovary Syndrome, high frequency audiometry, otoacoustic emissions

Hidden hearing loss in parents of children with congenital hearing loss: A preliminary report

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Introduction: Research in the recent past has revealed that several of the normal hearing individuals have subclinical damage to their auditory sensorineural systems which are overtly evident in terms of processing deficits in challenging conditions (Hidden hearing loss). The current study aimed to test the presence of hidden hearing loss in parents of children with congenital hearing loss (CHL). One or both the parents of children with CHL could be putative carriers of mutated genes responsible for hearing function leading to sub-clinical auditory deficits. If hidden hearing loss is found to be present, it could help in prevention and early identification of hearing loss.

Method: The study was carried out on 34 participants, who were divided into two groups. The first group consisted of 17 parents of children with congenital hearing loss, and the second group constituted 17 parents of children without hearing loss. The participants underwent Puretone audiometry (PTA), high frequency audiometry, immittance evaluation, speech perception in noise test (SPIN) gap detection test (GDT) and concurrent vowel identification test (CCV) as part of evaluations.

Results: High frequency audiometry showed significantly higher thresholds in the experimental group than the control group at 9kHz, 10kHz, 11.2kHz, 12.5kHz. GDT showed significantly poorer scores in the experimental group than the control group. CCV did not differ between the two groups. SPIN showed a significant difference between the groups at all the 3 SNRs (0, -5 and -10).

Discussion: The study revealed that possible carriers of mutated genes had deviances in high frequency hearing, temporal resolution abilities and speech perception in noise. It can be inferred that putative carriers of hearing loss causing genes have subtle threshold and suprathreshold processing deficits which may go unnoticed on routine clinical evaluations. Though the data is preliminary in nature, this may give way to more tools in order to evaluate the early indicators of mutated genes.

Conclusions: The results of the present study showed evidences for hidden hearing deficits at peripheral as well as central levels of the auditory system in parents of children with congenital hearing loss. This finding is first of its kind in the literature.

Key words: Congenital hearing loss, hidden hearing loss, Putative carriers of mutated gene, sub-clinical auditory deficits

Acoustic and perceptual analysis of stress in vocoded cochlear implant speech

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Introduction: Recent researches in the field of speech perception in cochlear implants (CI) have focused on studying the appropriateness of acoustic cues essential for the perception of segmental and suprasegmental features. Suprasegmentals refers to those properties of speech which do not belong to any single segment. Stress is the most prominent suprasegmental property referring to the relative force with which a sound, syllable or word is produced. Stress is cued by variations in acoustic parameters such as fundamental frequency (f₀), amplitude and duration. In spite of its importance in perception of communication intent, only a handful of studies have documented the variation in acoustic cues necessary for the perception of stress in vocoded CI stimuli. Thus, the present study was planned to investigate the perceptual and acoustic correlates of stress in terms of Tone Duration (TD), Tone Height (TH) and Peak Amplitude (PA) in vocoded vs natural speech.

Method: Ten Kannada phrases (noun + adjective) were recorded with no stress and with stress on the second word of the phrase. The phrases were vocoded to simulate ACE and CIS strategies using Angel SIM software (V1.08.01). Stimuli were bandpass filtered into 8 or 16 frequency bands (ACE and CIS respectively) using sixth-order Butterworth bandpass filters. Thus a total of 3 sets of stimuli, i.e., unprocessed phrases, ACE simulated and CIS simulated stimuli were perceptually and acoustically analysed to extract TH, TD and PA across both stressed and unstressed words.

Results and Discussion: Acoustic analysis revealed an overall increase in TH for both stressed and unstressed phrases in both the simulated conditions, with ACE simulated phrases showing more sizeable increase in TH. PA also showed a significant increase across both the simulated conditions for stressed and unstressed stimuli. Perceptual analysis suggested that the stressed phrases of the vocoded stimuli, in both the processing strategies were judged to be inappropriately stressed.

Conclusion: Acoustic analysis revealed that both the processing strategies resulted in change in the cues necessary for stress perception. Although, CIS processing strategy provided significantly better cues, perceptually, the stress pattern of both the processing strategies were judged to be inappropriate.

Keywords: Stress, Suprasegmental, Tone Height, Tone Duration, Peak Amplitude.

Evaluating the timescale of temporal fine-structure cues important for speech perception

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Introduction: For efficient understanding speech in the presence of noise, humans make use of temporal fine-structure (TFS) of the input signal. However, in a real life situation the entire time span of TFS information is not available and one has to scan through several short and discontinuous time samples (glimpses) of TFS to glean important perceptual cues. However, there is no literature as to what is the time scale of useful glimpses of TFS information to perceive speech efficiently in noise. Hence, the study was aimed at identifying the timescale of TFS that is important for speech perception.

Method: A repeated measures design was used to evaluate the aim of the study. Two experiments were conducted to evaluate the timescale of TFS important for speech perception. In one experiment the speech was noise vocoded and small portions of original TFS of speech was injected into the vocoded speech at regular intervals of 100ms. The intelligibility of sentences at several such small timescales was determined. The second experiment was conducted with slight variation to experiment 1. Here TFS and the noise portions were altered at regular intervals with both having the same duration. The intelligibility was assessed at multiple such time scales.

Results: There was a significant main effect of TFS timescale on the speech intelligibility in both the experiments. It was observed on pairwise comparison that there was a significant difference between all the conditions up till 70ms beyond which the scores saturated.

Discussion: The results of our data hint at a temporal integration time for the TFS to be around 70 ms, beyond which there is no appreciable improvement in speech perception. Results of both the experiments together hint at the usefulness of longer timescales of TFS information in the perception of speech. The study also emphasizes the role of top-down mechanisms in the perception of speech based on TFS. The current study is the first to introduce the concept of temporal integration time for TFS perception.

Conclusions: TFS information greatly influences speech perception in noise. The contribution of TFS to speech perception saturates at timescales of 70ms.

Key Words: Temporal fine structure, speech perception, timescales, speech perception in noise.

An acoustically evoked neurogenic short latency negative response in profound hearing loss

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Introduction: - A large negative deflection with 3-ms latency within the auditory brainstem response has been reported in some patients with peripheral severe to profound hearing loss. This negative deflection has been termed the N3 potential and it is assumed to be a vestibular-evoked potential.

Objective of the study: To look for the presence of N3 potential at two different intensities

Method: This is a retrospective study. A total of 822 ears with severe to profound hearing loss were studied from the participants in the age range of 1 to 40 years. The participants were divided into four groups 1-10yrs, 11-20yrs, 21-30yrs and 31-40yrs. Auditory brainstem response (ABR) was recorded at two intensities, 90 and 99dBnHL, to look for the presence of N3 potential.

Result: N3 potential was observed in 23.4% out of 822 ears at 90dBnHL and 34.3% at 99dBnHL. Presence of N3 potential in age group 1-10yrs was 14% at 90dBnHL and 29.4% at 99dBnHL, 11-21yrs was 27.6% at 90dBnHL and 35.2% at 99dBnHL, 21-30yrs was 23.9% at 90dBnHL and 35.2% at 99dBnHL, and 31-40yrs was 32.1% at 90dBnHL and 39.1%. Prevalence of N3 potential was higher in age group above 1-10yrs. When the intensity was increased there was direct proportion in amplitude and inversely proportion of latency as well as better wave morphology was observed.

Discussion & Conclusion: In the present study, N3 potential was present in 23.4% of the ears taken at 90dBnHL and in 34% ears at 99dBnHL. Ochi K et al reported the detection of N3 potential in 41.7% of the total ears but in our present study N3 potential was observed in 34% of ears. This may be due to the stimulus intensity of 105dBnHL in Ochi et al compared to 99dBnHL in the present study. This indicates that the stimulus intensity plays a significant role in the occurrence of N3 potential. It is better to use higher intensity for the identification of the N3 potential and thus we can assess both auditory as well as vestibular assessment (Saccular assessment).

Key Words: Saccular origin, N3 potential, auditory brainstem response, profound hearing loss

Cognitive influences on psychoacoustic performance

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Introduction: At the heart of psychoacoustic methods, is a cognitive component, which is clearly addressed in the theory of signal detection. Such influences of cognitive abilities in psychoacoustic tests seem to be inseparable while an ideal psychoacoustic task shall be immune to the cognitive abilities/deficits in population tested for accurate inferences about the auditory perception. The number of intervals employed in an alternate forced choice task might be closely linked to the extent to which it involves attention and memory of the participants. If the participant has compromised cognition due to aging, maturation or acquired disorders, then the number of intervals has to be chosen such that the results are not contaminated. Thus, the present study aimed at studying the influence of cognitive abilities on psychoacoustic methods involving differing number of intervals.

Method: Eighty-nine participants between the ages of 11 to 60 years participated in the study. A within-subject design was used to study the cognitive influence on gap detection thresholds (GDT) assessed in an adaptive staircase procedure with 2-interval, 3-interval, 4-interval and 5-interval alternate forced-choice procedure (AFC).

Results: Repeated-measures ANOVA showed a significant increase in the GDT with increasing number of intervals. The GDT in the 2IAFC and 3IAFC were similar and significantly lower compared to 4IAFC and 5IAFC. Additionally, the GDT in 4IAFC were lower than that in 5IAFC. This trend in thresholds disappeared when working memory and attention were considered as covariates.

Discussion: The GDT thresholds increased systematically with increase in the number of intervals. This increase could be attributed to cognitive status of the participants, namely the attention and working memory. When accounted for the cognitive abilities there was no difference in the GDT for differing number of intervals which suggests that the difference was primarily due to increased cognitive load on participants rather than affected auditory processing. The current study also lends evidence towards the use of 3IAFC procedure for evaluating auditory perception without the results being significantly influenced by the cognitive abilities.

Conclusion: The findings suggest that psychoacoustic procedures using alternate forced-choice methods are greatly influenced by the cognitive status of the participant.

Key words: Alternate forced choice procedures, psychoacoustic methods, attention, working memory, cognition.

Band importance of temporal fine-structure in speech

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Introduction: The relative contribution of temporal fine-structure (TFS) and Envelope (ENV) to the speech perception is an ongoing debate since last few years. Although the importance of TFS in pitch and speech in noise perception is experimentally proved, relative importance of TFS across different frequency bands is not yet understood. Such information would indicate the role of TFS in the perception of different classes of phonemes. Therefore the aim of the present study was to evaluate the importance of TFS in speech perception at different spectral regions.

Method: The study employed eighteen normal hearing adults. The stimuli used were eight lists of homogenous standardized Kannada sentences. These sentences were processed to extract TFS at six different octave frequency bands (125-250 Hz, 250-500 Hz, 500-1000 Hz, 1000-2000 Hz, 2000-4000 Hz & 4000-8000 Hz) using filter bank technique and Hilbert transform. Later, one among the six bands was masked with bandpass noise leaving the other bands unprocessed in the sentence (Masked TFS band condition). The same procedure was followed for the other bands in the sentences of other lists. Speech identification task was given and the responses were analyzed for the correctly identified keywords.

Results: Results showed that unmasked TFS speech showed the highest scores among all the conditions. Furthermore, masking TFS bands had a differential effect across frequencies. Among the masked TFS-band conditions, the bands 250-500 Hz and 2000-4000 Hz showed significantly lower scores compared to the other masked TFS-band conditions.

Discussion: From the results of the present study it can be inferred that TFS alone can aid in accurate speech perception. Among the TFS bands evaluated in the present study, masking of the bands, 250-500 Hz and 2000-4000 Hz resulted in drastic reduction in speech perception. This suggests that these two bands are the most important bands within the audiometric bands within which relevant speech information are embedded in the form of TFS.

Conclusion: The present study revealed that there is differential contribution of different octave frequency bands for TFS based speech perception. Of the frequency bands studied, maximum contribution was from 250-500 Hz and 2000-4000 Hz bands.

Keywords: Temporal fine structure, band importance, octave frequency bands, speech perception

Precision of measured noise levels in smartphone based applications

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Introduction: Technological advancement that has off late become indispensable for the dynamic world is the smart phone. Noise measurement applications belong to this congregation and are developed with the intention to assist the users in measuring day to day noise levels.

Need: Efficacy of measuring the ambient noise levels that interfere with hearing screening programs using smartphone is not evaluated till date.

Aim: To evaluate the precision of noise measurement applications across different android phones and an iPhone, in measuring ambient noise levels especially for the purpose of audiological screening.

Method: Eight android smart phones that belonged to two price ranges were selected for the study. Three applications that made least errors during our pilot measurement were chosen for the study. Experiment related noise measurements were done in two settings- sound treated room and real life situation. Initially, levels of 5 types of noises (Speech babble, white noise, cafeteria noise, traffic noise, pink noise) were measured in a sound treated room. Each noise was presented for 1 minute and measured using Type I SLM. Following this, phones were placed in the same position and noise was measured using each of the three applications. Average levels measured from noise measurement applications were noted. This procedure was repeated after calibrating the applications with reference to SLM reading. Field trials were conducted with them, using the 3 applications. Ambient noise measurements were done in 3 places (Marriage hall, open ground and patients' ward in a hospital).

Results: The noise levels measured from 8 smart phones using 3 different noise measurement applications were compared with the LAeq measured from Type 1 SLM. The application Soundmeter1 had mean measurement error within 5 dB compared to SLM. Whereas, the other two applications had measurement errors within 10 dBSPL. The measurements after calibration in controlled setting reduced measurement error of application 1 and 2 to within 2dB of SLM measurement.

Conclusion: Android based applications can be used by clinicians during audiological camps, as the measurement variability seen across the phones is acceptable for an estimate of noise levels required for hearing screening

Keywords: Smartphone, SLM application, Soundmeter, Noise.

Utilization of Smartphone based applications for rehabilitation of tinnitus

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Introduction: The idea that external sound can cover up the internally generated sound of tinnitus has led to the use of maskers for tinnitus. While hearing aids can be used as maskers of tinnitus in those with hearing loss, it is not an option in those with normal hearing. The technology available in smart phones is truly phenomenal and extremely helpful. There are applications developed for tinnitus rehabilitation which are easily downloadable, and user friendly. Hence the study aimed to evaluate the efficacy of using a smart phone based application for tinnitus rehabilitation of a group of individuals with normal to mild sensori neural hearing loss. 20 individuals (age range of 15 to 40 years) who presented with complaints of unilateral or bilateral tinnitus lasting over 3 months, participated in the study.

Method: Individuals were administered Tinnitus handicap inventory (THI) questionnaire developed in Kannada language (Zacharia et al., 2012) to evaluate the efficiency of using tinnitus pre and post of the treatment. "Relax Noise 3", a tinnitus masker app was selected based on good reviews and maximum downloads. The White noise level in the application was set to the most comfortable level (MCL) for each person. They were advised to use it whenever they had a relatively severe sensation of hearing tinnitus for 15 days- not more than three times a day. The post test was done after 20 days of using the 'tinnitus app' in smart phones.

Results: Statistical analysis was done. The mean handicap score for pretest was 42.5(8.6) and that of posttest was 20.6 (8.1). Wilcoxon sign rank test was administered which indicated a highly significant difference ($Z = -3.928, p < 0.001$). Thus, the individuals definitely benefitted by the use of the tinnitus masking application. Thus, it is our opinion that the multipurpose smartphones can be very effectively used in the management of tinnitus.

Conclusion: It can be concluded that there is a significant reduction in handicap with the use of the app. The price, popularity, availability as well as flexibility in timings make it a smart choice.

Key words: Tinnitus, Smartphones, Application, Technology

Comparison of neural response telemetry thresholds in perimodiolar and straight electrode arrays

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Introduction: A cochlear implant is a hearing device designed to restore hearing sensation in children and adults diagnosed as having severe to profound hearing impairment and who are observed to get limited benefit from hearing aids. Cochlear implants bypass the pass electrical pulses through an electrode array thus stimulating the auditory nerve to send signals to the brain. Electrodes are electrical connections which transmit the electrical impulses to the portion of the brain responsible for hearing (Wilson 2004). Electrical pulses are given to electrodes located at specified positions on an electrode array. Each electrode is placed in contact with a neuron which in turn stimulates the sound received with an appropriate frequency. An objective measure to check the integrity of the cochlear is the Neural Response Telemetry. Neural Response Telemetry is a non-invasive procedure which helps in estimating the telemetry thresholds. The NRT measurement gives the electrically evoked compound action potential recorded on various positions of the electrode array by delivering electrical pulses to the nerve cells.

Aim and objective: The aim of the study was to investigate the neural response telemetry based on the type of electrode array used.

Methodology: Thirty children of 2 to 10 years of age undergoing rehabilitation in the centre following cochlear implantation surgery were included in the study. The participants had congenital severe to profound hearing loss bilaterally. Fifteen children each were implanted with straight electrode array and with perimodiolar electrode array. The neural response telemetry was obtained using the Custom sound software and the recording parameters.

Results: Results indicated that ECAP recordings measured through neural response telemetry were statistically significantly lower in children with perimodiolar electrode array compared to those with the straight electrode array.

Discussion and Conclusion: The insertion of the perimodiolar electrode array is deeper and positioned close to the modiolus whereas the straight electrode array is positioned close to the lateral wall hence the current levels required for stimulation to elicit electrically evoked compound action potentials were lesser than that required for the straight electrode array.

Key words: Cochlear implant, Neural response telemetry, Straight array, pre modiolar array, compound potentials

Perceptual Difficulties of Listening in Elderly Adults with Age Related Hearing Loss

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Introduction: Age related cognitive and perceptual decline contributes to difficulty in listening in complex listening situations which cannot be predicted from traditional hearing tests. The Speech, Spatial, and Qualities of Hearing Scale (SSQ) is one of many such questionnaires which have been developed in other countries to assess self-reported hearing difficulties. The present study aimed at assessing the perceptual difficulties of listening in elderly adults with age related hearing loss in an urban populated area.

Method: In order to achieve this, SSQ was modified to match the listening situations in regional context. SSQ was translated to Odia by the co-authors and verified by a linguist. Pure tone Audiometry and SSQ was administered to 31 elderly adults (55-75 years) with moderate to moderately severe sensorineural hearing loss not using hearing aid. Repeated measure analysis of variance (ANOVA) was performed on the rating obtained in the three subsections of SSQ.

Results and Discussion: The ratings obtained were lower compared to previous study may be because the hearing thresholds of the subjects in the present study were poorer compared to participants in the other studies. ANOVA revealed that the difference in rating on speech, spatial and quality subscale of SSQ was significantly different among the participants. There was significant difference between rating obtained in speech and quality, spatial and quality subset of SSQ and there was no significant difference between speech and spatial subsets. The difference remained significant even if the PTA was entered as a covariate and the difference in rating was no longer significant when age was entered as a covariate. This finding suggests that the listening difficulties in the elderly adults with hearing loss is not restricted to sensory loss only but rather was dependent on the sensory-cognitive decline which occurs with ageing.

Conclusions: The finding of this study suggests that the hearing difficulty of elderly adults cannot be explained on the basis of audiometric results only but degradation of auditory stimuli which occurs with ageing should also be taken in account while devising their rehabilitation.

Keywords: Pure tone audiometry, Cognition, Perception, Rehabilitation

Assessing the use of a walkie-talkie based wireless communication system to administer Behavioral Observation Audiometry -A pilot study

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Introduction: Behavioral observation audiometry (BOA) is a nonreinforcement subjective procedure used in hearing screening of infants and young children (Northern & Downs, 2002). It requires sound treated two-room set up in which, the tester with the audiometer is in one room and the observer with the child in the adjacent room. The tester presents calibrated sounds (stimulus) of different frequency and intensity to the adjacent room through sound field speakers. The role of the observer is to observe the child's various reflexive or active age appropriate behavioral responses (head turn, startle, eye gaze, increase & decrease of ongoing activity etc.) according to Auditory Behavioral Index. The communication between the tester and the observer during the test includes information on the child's response interpreted as "hearing" to various auditory stimuli.

Method: Step 1: A wireless communication system, walkie-talkie (W-T) was introduced in the sound treated rooms. One W-T was given to the tester and the other to the observer.

Step 2: Testers and observers who performed the BOA testing were trained to use the W-T

Step 3: Five children were included in the study. For each child two BOAs were done, one without using the W-T and then using the W-T to compare the difference.

Step 4: The results obtained were analyzed for the thresholds, time taken for the testing, and the feedback from tester and the observer. Thus efficacy of the wireless communication system was studied.

Result: The main findings of this study are 1) Wireless communication system helped in conveying formal instruction between the tester and the observer which facilitated guided learning; 2) The batteries in the walkie-talkie lasted for 12 hours hence there was no interruptions during testing; 3) The walkie-talkie helped in easy mobility of the observer, resulted in more accurate response documentation; 4) There was time to time information transfer from the observer to the tester on the responses to the auditory stimulus; 5) It consumed less time.

Discussion and Conclusion: The walkie-talkie is a cost efficient mode of wireless communication system that can be introduced easily in audiological procedures. The wireless communication system using walkie-talkie was found to be an effective tool in behavioral observation audiometry.

The system had some challenges such as; Signal transfer was not there when the tester and the observer talked at the same time and so training is required before using the walkie-talkie.

Further research can be done to overcome these challenges. Extensive studies on the advantages of this walkie-talkie in test procedures like speech audiometry and benefit trial of hearing aid can be done.

Keywords: BOA, W-T, Tester, Observer

Effect of Stimulus Parameters on Contralateral Suppression of Transient Evoked Otoacoustic Emission

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Introduction: Otoacoustic emissions (OAEs) are low-level sounds reflecting the non-linear active processes of the cochlea. A sensitive microphone, placed firmly at the entrance of the external ear, detects the energy originating from the cochlea passing through the middle ear. Transient evoked OAEs (TEOAEs) suppression refers to the reduction of the amplitude of the TEOAEs. However, there is dearth of studies in exploring TEOAEs suppression using linear and non-linear mode of recording. Hence, the present study aimed is to compare the stimulus acquisition parameters effect on contralateral suppression (CS) of TEOAEs across age groups.

Method: A total of 34 individuals with normal hearing in the age range of 10 to 60 years participated in the study. All the participants were ruled out for peripheral hearing loss in both ears using basic audiological evaluation. TEOAEs were recorded for 260 sweeps of clicks in both nonlinear and linear paradigm with presentation level of 80dB SPL, in presence and absence of noise. TEOAEs were recorded 2 times from each participant across frequencies in between 1k Hz to 4k Hz.

Result and Discussion: The results of the repeated measure of ANOVA revealed that both linear { $F(120, 4) = 5.41, p < 0.001$ } and non-linear { $F(120, 4) = 3.02, p < 0.02$ } mode of stimulation for CS of TEOAEs, were statistically significant across frequencies. However, there were no statistically significant difference observed across different age groups for both linear { $F(12, 120) = 0.78, p < 0.665$ } and non-linear { $F(12, 120) = 1.43, p < 0.15$ } mode of stimulation. Present study results is in consonance with study done by Von Specht et al. (2001) where they also did not find differences across different age groups. The differences observed at few frequencies in present study could be explained with anatomical representation of the efferent system. Effects of the MOC efferent system is probably more diffused in terms of frequency specificity because MOC axons course in the intraganglionic spiral bundle.

Summary and Conclusion: The present study suggests using either linear or non-linear mode of stimulation does not have impact on contralateral suppression of TEOAEs across different age groups.

Key words: Otoacoustic emission, Outer hair cells, Cochlea, Transient evoked otoacoustic emission, Contralateral suppression

Importance of radiological evaluation in pre cochlear implantation assessment- a single case study

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Introduction: Case X (9 months/ Female) who was diagnosed to have severe to profound hearing loss was referred to our Institute for an Aided audiogram as child was not responding to sounds and not speaking using hearing aids.

Method: Aided Behavioral Observation audiometry was done bilaterally and the responses were not within the speech spectrum. Hence was recommended for Cochlear Implant. Pre cochlear implant assessment included Behavioral Observation Audiometry (BOA), Immittance audiometry, Oto acoustic emission, Auditory Brainstem Response, Speech and Language evaluation, Psychological evaluation, Occupation therapy and Radiological evaluation.

Result: Radiological evaluation results revealed Mondini's defect with hypoplastic cochlear nerve and dilated cochlear aqueduct in the right ear and Common cavity (cochlea and vestibule) with absent cochlear nerve and lateral semicircular canal in the left ear. Based on radiological evaluation cochlear implantation was done for the right ear. Post surgery Aided BOA responses were within the speech spectrum.

Discussion: Client is attending auditory verbal therapy and performing well. Findings of the MRI gave insight to the diagnosis of the client which led to appropriate ear for implantation.

Conclusion: MRI is the gold standard to identify structural deficits in the auditory system. Therefore Audiological findings along with Radiological findings will give a clear idea about the decision of the ear for cochlear implantation and in turn helping the child to perform better.

Keywords: Radiological evaluation, Cochlear implant, Mondini's defect, Common cavity.

Sensorineural Hearing loss in Mucosal type of Chronic Suppurative Otitis Media.

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Introduction: Sensorineural hearing loss (SNHL) is rare but well established complication for Chronic Suppurative Otitis media (CSOM).

Aim and Objectives: The occurrence of SNHL in mucosal type of CSOM. Pattern (Relation) of sensorineural component with age of the patient, duration of the disease.

Method & Materials: A study was analyzed retrospectively from June 2014 to July 2015 at Department of Otolaryngology head and neck surgery, SNMC & HSK Hospital, Bagalkot, Karnataka. A total of 115 cases of CSOM were studied for the pattern of hearing impairment on the basis of pure tone audiogram.

Results and Discussions: Out of total 115 cases 22(19%) has SNHL affecting 11 males and 11 females with males to females ratio 1:1. The mean age was 36.5yrs. It was found that the incidence of SNHL progressively increased with increasing duration of disease. Mean bone conduction threshold at 1 KHz, 2 KHz and 4 KHz were 31.8, 37.2 and 43.4 respectively. The mean air conduction threshold at 1 KHz, 2 KHz and 4 KHz were 54.0, 59.5 and 69.5 respectively. The mean Air Bone gap at 1 KHz, 2 KHz and 4 KHz were 22.2, 22.3 and 26.1 respectively.

Conclusion: Significant SNHL was seen in our study. The higher frequencies were affected. Age of the patient did not have any significance, but duration of disease had impact on SNHL.

Keywords: Mucosal type of CSOM, Sensorineural hearing loss, Degree of hearing loss.

Effect of Noise on Perception of Clear And Conversational Speech in Individuals with Auditory Neuropathy Spectrum Disorder (ANSD)

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Introduction: Studies have focused on the speech perception in noise among individuals with Auditory Neuropathy Spectrum Disorder (ANSD), and have also proposed that impaired capacity of temporal processing as one of the primary reasons for the difficulty in speech perception in noise. However, very few studies have concentrated on the perception of intelligibility-enhancing style of speech or clear speech in background noise. Thus the current study was carried out to investigate the effect of noise on perception of clear and conversational speech in individuals with ANSD.

Method: Two groups of participants in the age range of 15 to 40 years participated in the study. Group 1 consisted of 20 normal hearing individuals and group 2 participants were confirmed cases of late onset ANSD. Eight list of phrases developed by Hemanth and Akshay (2015) were used for speech perception. Four lists were recorded in clear speech condition and remaining four lists of phrases were recorded in conversational speech condition. 3 clear speech phrase lists and 3 conversational speech phrase lists were digitally mixed with speech babble noise at +10, +5 and 0 dB SNR using the SNR MATLAB code and one list in each condition was presented in quiet. Also temporal processing abilities were assessed using gap detection test (GDT).

Results and discussion: It was evidenced from the results that, individuals with ANSD showed highest speech perception scores for the clear speech compared to the conversational speech. This was true for quiet as well as in all noise conditions. There was a strong negative correlation between GDT and phrase perception score in each experimental condition, indicating that the higher GDT was noted in individuals having lower phrase perception scores.

Conclusion: To conclude, at reduced SNR, the cues from clear speech were made available for the listeners to repeat the phrases. Thus the effect of reduced temporal resolution and hearing loss has been partly lessened by clear speech.

Key words: ANSD, Temporal resolution, Clear speech, Phrase perception

Effect of Real World Noise and Audiometric Noise on Consonant Identification

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Introduction: Speech perception is the process by which the sounds of language are heard, interpreted and understood. The study of speech perception extends outside of audiology and auditory science into the fields of phonology and phonetics in linguistics and cognitive psychology and perception in psychology.

Aim of the study: The aim of the study is to understand the effect of noise types on consonant perception in individual with normal hearing sensitivity [audiometric noises (white band noise, broadband noise, speech babble noise & real world noises)].

Objective of the study: The primary objective aims to find out the effect of real world noises on consonant identification among normal hearing individuals in comparison to broadband noises and the secondary objective aims to elucidate perceptual errors in consonant identification in competing noises.

Methods: Participants: 30 healthy adult Kannada speakers with the age range of 18 – 30 years having normal hearing sensitivity in both the ears.

Selection of participants: Only those individual whose hearing sensitivity is within normal limits (PTA < 15 dB), bilateral 'A' type tympanogram with both ipsilateral and contralateral reflexes present and speech identification scores on standard speech audiometry test being greater than 95% will be included in this study. Stimulus preparation: 20 Kannada consonants in intervocalic position (/ aCa/) were recorded using praat software and used as stimulus. Each of these stimulus tokens were added to 4 different types of real world noise and also to broadband noise.

Procedure: The subjects were given a task of repeating the consonant heard in the presence of each of the noises selected (SNRO dB). And percentage correct scores as well as analysis of error type & distinctive feature analysis will be carried out.

Result: The noise type had a major effect on percentage identification scores. Spectral envelop of noise is important in increasing perceptual errors of consonant identification. Voicing errors were less seen compared to place and manner errors.

Key words: CI(consonant identification), PTA (puretone audiometry), SIS(speech identification score), BBN (broad band noises)

Evaluation of attitudes towards persons with disabilities among prospective speech and hearing professionals, engineers and doctors

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Introduction: Over years there have been many studies done to assess the attitude of non-disabled individuals toward people with disabilities. However, there are very less studies done in India (Tharyan et al., 2001) to know about the attitude of students towards people with disabilities. The purpose of this research is to explain the variation (if any) in the social awareness and support of people for persons with disabilities by delineating the different attitudes in prospective students of different profession.

Method: The different professions included as samples are students from speech and hearing field (60), engineering students (60) and medical students (60). The study collected self-reported data using two questionnaires namely, Attitudes toward Disabled Person (ATDP) and Multi-dimensional Attitudes Scale toward Persons with Disabilities (MAS). The relationship between the scores obtained and the duration of contact with the person with disability was explored.

Results: The results of the study showed that all the participants scored had positive attitude towards persons with disabilities. The results of MANOVA showed that there were no significant differences in scores for MAS and ATDP across students of different profession. The scores were higher for MAS-behavior ($p < 0.05$) in females compared to males in all the professions. In addition, the scores were higher for individuals who had contact with person with disability. There was a positive correlation between the scores obtained and the years of training for speech and hearing students.

Discussion: The result of the study suggests that attitudes towards persons with disabilities don't change among students of different professions. This is a positive sign for the society and would aid in equal opportunities, full participation and protection of rights of persons with disability. The attitude was more positive for females compared to males similar to other studies (Tharyan et al 2001; Au & David, 2006). The scores were higher for final year students compared to first year which suggests inculcating positive attitudes with more exposure to clinical population.

Conclusions: The study suggests that there is a positive attitude for persons with disabilities among prospective speech and hearing professionals, doctors and engineers.

Key Words: Attitudes, students, speech and hearing, engineers, doctors, behavior, disabilities.

Effect of smoking on hearing ability in industrial workers

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Introduction: Hearing loss is very common in industrial workers due to exposure of long-term noise. Noises are a periodic sound that is produced by some mechanical activity, loud enough to decrease hearing and other effect on human. Rosen, Sixt, and Sundh (1993) found a positive relation between hearing level and smoking. The effect of smoking on hearing loss is not clearly expressed, because of many conflicting situation like noise exposure, aging, alcohol consumption. The aim of this study is to find the frequency specific smoking effect in non-smokers and smokers working in industries.

Method: Twenty subjects between age group of 20-40 years were included in this study, out of which ten subjects were non-smokers and ten subjects were smokers. All the subjects were working in the industries longer than one year and have normal hearing level at the time of joining. Verbal consent were obtained from the participants. Pure tone audiometry testing was conducted in sound treated room. Pure tone air-conduction and bone-conduction thresholds were measured.

Results: Pure tone audiometry test were administered for both group at 250Hz, 500Hz, 1KHz, 2KHz, 4KHz, 8KHz to see the auditory effect of smoking in the age group of 20-40 years. MANOVA test were done to see the frequency specific smoking effect in both the group. Results revealed that hearing threshold is significantly better ($p < 0.001$) in non-smokers than smokers.

Discussions: The result of present study suggests that smoking may accelerate NIHL. The period of audiometric re-evaluation should be decreased for smoker workers exposed to noise. Long term smoking would exaggerate the circulatory system of cochlea. Cigarette smoking may affect hearing, as it has adverse effect on antioxidative mechanisms or on the vasculature supplying the auditory system. Smoking may have direct ototoxic effects on hair cell function because it affects the neurotransmission of auditory stimuli.

Conclusion: The study reveals that smoking for longer duration can lead to hearing loss. More numbers of cigarette intakes are a risk factor for hearing loss. Modification of cigarette smoking can prolong the hearing loss.

Key words: Pure tone audiometry, Smoking, NIHL, Hearing

Frequency specific gap detection abilities in cochlear implant children

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Introduction: Gap detection is used as one measure of the temporal resolving power of the auditory system. Temporal processing is the rate at which we can process auditory information. A person must be able to process auditory information at a rapid pace in order to develop appropriate listening and language skills. Cochlear Implant users have more difficulty in understanding speech sounds than listeners with normal hearing because their ability to discriminate frequency is limited. Thus the purpose of the present study is to assess the frequency specific temporal resolution skills in Cochlear implant users.

Method: The procedures of the test were explained to the participants. The informed consent was obtained from all the participants. Gap detection threshold was measured in 20 subjects of cochlear implant children (post implant duration 2-15 months). Gap detection thresholds were measured for 500Hz, 1KHz, 2KHz, and 4KHz frequencies in all subjects. The subjects were instructed to listen to the set of three noise stimuli, one of the three stimuli contain a gap of varying duration. Subjects had to make a note where the gap was identified in each set of stimuli.

Results: Responses were noted down and analyzed with SPSS 17 software. t-test were carried out to evaluate the gap detection thresholds at frequencies 500 Hz, 1 KHz, 2 KHz & 4 KHz. Results of t-test revealed that there were no significant differences noticed between frequencies in cochlear implant children.

Discussions: It was observed that the low frequency (500Hz) has got poorer thresholds in comparison with other frequencies in cochlear implant children. This could be due to the auditory filter for low frequencies are broader than the high frequencies.

Conclusion: The present study reveals that there is no effect of post implant age duration on frequency specific gap detection in cochlear implant children. This result will help in implementation of therapy in cochlear implant children.

Key words: Gap detection threshold, Cochlear implant, Frequency, Temporal resolution

Effect of music training on higher cognitive skills

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Introduction: Musical training is a rigorous routine involving the segregation of vocal and instrumental sounds presented concurrently. Musicians have a superior ability to detect subtle difference in signals and have a better short term working memory. Short term memory is thought to be the stage where the information is just processed. Its memory capacity is about 7 ± 2 items. Studies have also demonstrated that musical training enhances pitch pattern recognition and increase the verbal memory pre-school children's phoneme awareness skills and early reading skills are correlated with their musical training.

Objective: To investigate the effect of music training on higher cognitive skills, Short-term auditory working memory (Digit Forward and Digit Backward span test) and P300 in a group of trained musicians and non-musician controls.

Method: A total of 20 subjects comprised 10 musicians and 10 non musicians were taken, aged between 16-30 years. The participants underwent preliminary hearing evaluation before behavioral and electrophysiological testing. Digit Forward and Digit Backward span tests and P300 test was carried out followed by the calculation of Fz, Cz, and Pz amplitude.

Result: There was a significant difference in Digit forward & backward scores ($p < 0.05$) and the amplitude of P300 ($p < 0.05$) in musician group as compared to non musician group.

Conclusion: These findings suggest that musical experience helps to enhance neural coding to discriminate subtle differences and enhance auditory working memory.

Key words: Digit Forward span test, digit backward span tests, p300, cognitive skills

Evaluation of Auditory Brain Stem Function in Elderly Type 2 Diabetes Mellitus Patients with Senile Presbycusis

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Introduction: Diabetes mellitus (DM) is the most common endocrine disease. It is a progressive metabolic disorder, characterized by abnormalities in glucose utilization due to absolute or relative insulin deficiency. Over time, hearing impairment is one of late complications of DM which depends upon the type of diabetes, duration and instability in blood sugar level.

Objectives: The aim of this study was to evaluate hearing function and possible correlations between alternations of the auditory brain stem function in elderly type 2 DM with presbycusis and to compare the data with elderly healthy non-diabetic controls with presbycusis.

Materials and Methods: This study was done in 35 elderly type 2 DM subjects with presbycusis and 35 non-diabetic presbycusis. Out of data from 140 ears [70 subjects (35 diabetic & 35 non-diabetic)], in diabetic group, data of 10 ears were not under normality, and in non-diabetic group, data of 16 ears were not under normality. So a total data of 124 were selected for statistical analysis i.e., 65 from diabetic group and 59 from non-diabetic group. All were submitted to full audiological history taking, ontological, basic audiological evaluation and Auditory brainstem response audiometry, which was recorded in both ears followed by calculation of the absolute latencies of wave I, III and V, as well as interpeak latencies I-III, III-V, I-V.

Results: Elderly type 2 DM with presbycusis patients showed statistical significant both SRT and SDS ($P < 0.05$) as compared with non-diabetic group. The absolute latencies of wave I, III & V are significantly more in diabetic group as compared to non-diabetic group at ($P < 0.05$) level of significance and the interpeak latencies of wave III-V & I-V are significantly more in diabetic group as compared to non-diabetic group at ($P < 0.05$) level of significance. Interpeak latencies of wave I-III are more in diabetic group as compared to non-diabetic group, but are not significantly different ($P > 0.05$).

Conclusions: ABR can represent a useful, simple procedure to detect both acoustic nerve and central nervous system damage. It seems that ABR test should be the mandatory test for diagnosis of any auditory alterations and periodic evaluation on diabetic patients for treatment and intervention regarding metabolic regulations.

Keywords: Brainstem evoked response audiometry. Type 2 diabetes mellitus, Presbycusis

An Evaluative Study of Auditory Brain-Stem Evoked Response Patterns in Patients with Migraine

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Introduction: Migraine is a benign and recurring syndrome of unilateral throbbing headache, associated with nausea, vomiting and phonophobia. Some researchers are of opinion that migraine patients may have vertigo, tinnitus, pitch distortion, phonophobia and hearing loss. Before puberty, migraine prevalence is higher in boys than in girls. As adolescence approaches, incidence and prevalence increases until approximately age 40, after which it gradually declines.

Objectives: The aim of this present study was to evaluate, if there is any abnormality in neural conduction in auditory pathway in migraine patients having normal hearing sensitivity when compared to age matched healthy populations.

Materials and Methods: This study included 31 subjects diagnosed as having migraine were taken experimental group and 31 subjects with age, sex matched having no complaint of migraine were placed on control group. All these patients were subjected to clinical evaluation of audiological history, otological examination, basic audiological evaluation and auditory brainstem response audiometry which was recorded in both ears, followed by calculation of the both absolute (I, III and V) and interpeak (I-III, III-V and I-V) latencies separately in both ears.

Results: There was a significant difference in absolute latency of wave I ($P < 0.05$) and Interpeak latency of wave I-III and I-V ($P < 0.05$) between experimental group and control group in both ears. No significant difference of interpeak latencies (III-V) was observed between experimental and control group in both ears ($P > 0.05$).

Conclusions: It can thus be said that the patients with migraine are more likely to have auditory brainstem involvement. The auditory brainstem evoked response audiometry is an effective tool in making both neurophysiology and pathophysiology explanation of migraine. This study is another step to know the effect of migraine on both cochlear and any vestibular apparatus, so that detailed diagnostic can be undertaken in patients with migraine.

Key words: Brainstem evoked response audiometry. Migraine, absolute latency, interpeak latency.

Comparison of Distortion Product Otoacoustic Emission in Normal birth and Caesarean Birth Neonates

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Introduction: This study of Newborn Hearing Screening was undertaken in order to compare of Distortion Product Otoacoustic Emission (DPOAE) amplitudes among infants with normal and caesarean birth. 100 normal birth and 100 caesarean birth subjects (400 ears) served as control and experimental group respectively.

Methods: Neonates who passed High Risk Register (HRR) were taken as subjects. DPOAE's were done at 24 hours (1st day), 72 hours (3rd day) and 120 hours (5th day) post birth in both the groups. DPOAE's amplitudes were obtained for 2 kHz, 3 kHz, 4 kHz, and 5 kHz. Intensities were default at L1=55 dB and L2=65 dB. Multivariate ANOVA with Post-hoc analysis was performed to analyze DPOAE amplitudes obtained among the groups at 24 hours, 72 hours and 120 hours post birth, across four frequencies 2 kHz, 3 kHz, 4 kHz and 5 kHz.

Results and Discussions: Results revealed increased DPOAE amplitude for normal and caesarean birth subjects from 1st day to 3rd day. And they matched the values of control group on the last evaluation. Caesarean births neonates found to have lesser amplitudes than normal birth neonates on the first and third day. Equivalent results were found for both caesarean and normal birth neonates on the fifth day. These results reveal that the normal birth neonates tend to have better amplitudes than the caesarean birth neonates during first few days of postnatal age. Studies show the presence of amniotic fluid in the middle ear which could account for reduced DPOAE amplitudes. As absorption of amniotic fluid takes place in the middle ear over a period >72 hours after birth, hence DPOAE amplitudes get better.

Conclusions: The findings of this study suggests that newborn screening in caesarean birth should be preferably greater than 72 hours or a week after delivery which would reduce the false positive rate and parental concerns regarding the infants hearing.

Auditory brainstem response and cervical vestibular-evoked myogenic potential in the evaluation of adult brainstem glioma: A case-study

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Introduction: Brainstem gliomas account for 1%–2% of adult intracranial gliomas. In adults, a low-grade phenotype predominates occurring in the age range of 20 -50 years.

Need for study: Although audio-vestibular test battery is well-known in the assessment of acoustic tumours, it has not been reported in assessment of brainstem glioma. Further, with the advent of MRI, auditory brainstem response audiometry (ABR) has been said to be obsolete in neuro-diagnosis. The authors wish to make a case for the use of ABR with cervical vestibular-evoked myogenic potentials (cVEMP) in neurodiagnosis.

Method: PD, a 23 year old female diagnosed with low-grade brainstem glioma presented with loss of balance, vomiting, oscillopsia & nystagmus. MRI revealed a well-defined mass (1.3X1.6X2.2cm) in dorsal right pons and ponto-medullary junction. She was taken up for audio-vestibular evaluation: pure-tone audiometry (PTA), ABR and cVEMP.

Results: PTA revealed bilateral mild sensorineural hearing loss. ABR showed good wave morphology bilaterally. Left ear revealed normal values for absolute latencies of waves I, III, V & inter-peak latencies (IPL). Right ear showed delayed waves III & V with normal wave I. The IPL III-I & V-I were severely prolonged at all rates. Inter-aural latency difference for waves III and V was greater than 0.4ms. No cVEMP could be obtained from the right ear while cVEMP in left ear showed normal latency but severely reduced amplitude.

Discussion: Findings were consistent with retrocochlear lesion in lower brainstem near the ponto-medullary junction, as the generator of wave III of ABR is the cochlear nucleus located at this site. Bilateral abnormality on cVEMP is postulated to reflect the effect of glioma on the descending vestibulo-spinal pathway of cVEMP. Contralateral effect of the glioma on cVEMP was surprising considering the size of tumor < 2.5 cm. It needs to be studied if this finding is typical of gliomas as opposed to extra-axial tumors.

Conclusions: This case-study highlights the utility of ABR and cVEMP as a battery to diagnose brainstem tumors, not necessarily only acoustic neuromas. Any lesion in the bottleneck of CP angle has marked influence on audio-vestibular tests thus making them quick, cheaper non-invasive diagnostic tools.

Key words: brainstem glioma, auditory brainstem response, cervical VEMP, audio-vestibular test-battery.

Beyond a successful treatment of tinnitus: insight into factors affecting treatment with tinnitus masking

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Introduction: The present study was undertaken as there is dearth of studies investigating the prognostic indicators of improvement with masking therapy in individuals with tinnitus.

The objectives of the study were to investigate the association of age, degree of hearing loss and severity of tinnitus with that of an improvement with masking therapy. Similarly, association of Pitch and loudness of tinnitus with an improvement with masking therapy was studied. Furthermore an effect of associated symptoms on overall improvement was also investigated

Method: It was a retrospective study of forty individuals who had a chief complaint of tinnitus. The age range of the studied population varied from 15 to 40 years. A detailed case history, audiological test results, tinnitus evaluation results and score on THI (tinnitus handicapped inventory) pre and post masking therapy were recorded from the patient's file.

Results and Discussion: Data was analysed using SPSS statistical software for social sciences version 18. Results revealed that there is a strong positive relationship between severity of tinnitus and amount of improvement with masking therapy ($r= 0.74$, $p<0.01$). While negative correlation was observed between the age of the participants with an overall improvement due to masking therapy computed using THI ($r= 0.34$, $p<0.05$). No significant relationship was found between degrees of hearing loss, pitch, loudness of tinnitus with overall improvement due to masking therapy. Furthermore, for the last objective, subjects with no associated symptom showed greater degree of improvement than the group with associated symptoms

Conclusion: Severity of tinnitus, age and associated symptoms affects the overall improvement with masking therapy in individuals with tinnitus. While pitch, loudness of tinnitus and degree of hearing loss do not play a significant role in determining the amount improvement with masking therapy

Keywords: tinnitus, masking therapy, associated symptom, THI

226 Hz Vs 1K Hz tympanometry in identifying middle ear pathology

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Introduction: Conventionally, tympanometry is carried out using 226 Hz probe tone, but a few studies indicate that multicomponent tympanometry for high frequency probe tones may be more useful in early identification of middle ear pathologies. The present study was undertaken to compare the clinical utility of multicomponent tympanometry using 1000 Hz probe tone and conventional tympanometry in identifying middle ear dysfunction.

Method: Single component tympanometry for 226 Hz and multicomponent tympanometry for 1000 Hz probe tone was carried out on 20 ears with no history of middle ear pathology (Group I) and 13 ears with history of middle ear problems (Group II).

Results and Discussion: All the participants of Group I had hearing sensitivity within normal limits. Tympanometry revealed A type tympanogram for 226 Hz and 3B1G tympanogram for 1000 Hz in all the 20 ears. In Group II, all the ears except one showed conductive hearing loss. Tympanometry for 226 Hz revealed B type tympanogram in 4 ears, Ad type in 3 ears and As type in 1 ear. Remaining 5 ears showed A type tympanogram. Multicomponent tympanometry for 1000 Hz showed abnormal shapes in 10 out of 13 ears. Using 226 Hz probe tone, only 4 out of 13 ears (30.76 %) could be clearly diagnosed as having middle ear pathology, the results were equivocal in 4 (30.76 %) ears and it failed to identify middle ear pathologies in 5 (38.46 %) ears. However, multicomponent tympanometry identified middle ear pathologies in 10 (76.92 %) ears. The abnormalities seen for 1000 Hz tympanogram were suggestive of mass dominant middle ear. These findings highlight the usefulness of high probe tone in detecting effects of increase mass. Thus, the results of the present study reinforce the concept that multicomponent tympanometry is useful in identifying mass dominated middle ear pathologies.

Conclusion: Multicomponent tympanometry for 1000 Hz is more sensitive than conventional tympanometry in identifying middle ear infection.

Keywords: susceptance, conductance, multicomponent tympanometry, high frequency probe tone, middle-ear pathology

Comparison of the immittance results using different probe frequencies

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Introduction: The middle ear should be normal for proper sound propagation from air filled external ear to liquid filled inner ear. Immittance audiometry is a non behavioral test assessing middle ear function usually obtained using three different probe frequencies such as 226Hz, 678Hz and 1000Hz . The aim of the present study was to compare the tympanogram compliance and B&G (Susceptance and conductance) using different probe frequencies in normal hearing adults.

Method: 30 subjects in the age range of 18 to 22 years with normal hearing participated in the study. All subjects had pure tone average of less than 15dB as well as of 'A' type tympanogram with bilateral reflexes present. Subjects with otological symptoms, hearing loss & neurological symptoms were excluded from the study. Tympanometry was carried out in a well illuminated sound treated room using a calibrated GSI tymptstar middle ear analyzer to find out compliance as well as B&G using different probe frequencies i.e. 226Hz, 678 Hz & 1000Hz. All the subjects were comfortably seated and instructed not to swallow as well as move the head while testing. Results of compliance as well as B&G were compared across different frequencies as well as across ears.

Results: Highly significant difference were obtained (p value less than 0.001) between the results of compliance as well as B&G across different frequencies but there was no significant difference obtained across ear

Discussion: Results clearly show that the change in probe frequencies will affect the results of immittance audiometry.

Conclusion: For effective audiological intervention, proper and clear evaluation measures are required in which instrumentation, stimuli used etc are very important considerations. Tympanometric compliance as well as B & G results are susceptible to probe frequencies, hence, careful selection of probe tone should be maintained by the audiologists for the proper diagnosis.

Keywords: Immittance, probe frequency, compliance, Susceptance and conductance, tympanometry

Effects of hormonal changes in speech perception in noise and auditory working memory in females

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Introduction: The menstrual cycle is a cyclic fluctuation of ovarian hormonal level in every female. Many electrophysiological, psychoacoustic, neurobiology and cognitive neuroscience studies have focused on the effect of changes in gonadal steroids (estradiol and progesterone). These changes can alter central auditory processing and auditory working memory during menstrual cycle. The present study was conducted with the aim to assess the effects of hormonal changes in speech perception in noise and auditory working memory in females.

Method: A total of 10 female participants with an average 28 days of regular menstrual cycle in the age range of 18-25 years were included in this study. All females were native Kannada speakers. Speech perception in noise test was assessed through Quick-SIN in Kannada and auditory working memory were assessed using forward and backward digit span test. All participants were tested two times during a single menstrual cycle i.e., menstrual phase (cycle days of 1-3 days, lowest estrogen and progesterone), and ovulation (cycle days of 12-15 days, high estrogen and low progesterone).

Results: The obtained data was subjected to statistical analysis using SPSS software (version 17) and paired t-test was done. The results showed that speech perception in noise and auditory working memory differed significantly across two phases of the menstrual cycle; wherein the ovulation phase had better speech perception in noise test and auditory working memory compared to that of menstrual phase. It may be hypothesized that higher estrogen level increases glutamate excitatory neurotransmitter resulting in faster axonal conduction of auditory processing at the cortical level. Thus, auditory processing and auditory working memory are better during the ovulation phase compared to that of menstrual phase.

Conclusion: To conclude, hormonal fluctuation between two phases of regular menstrual cycle affects speech perception in noise and auditory working memory in females. Thus, central auditory processing system is sensitive to slight fluctuation of hormonal changes. The study helps in understanding which hormone has more effects on speech perception ability in noise and auditory working memory. Moreover, this study provides further insight about the effects of hormonal agents like steroids and contraceptive on hormonal synthesis and its effects in central processing of auditory information. Further, the present study will highlight the importance of considering the menstrual phase while studying the female participants.

Keywords: Speech in noise, Menstrual cycle, Estrogen, Progesterone, Auditory processing, Ovulation

Co-relation between pure tone threshold and acoustic reflex threshold in normal hearing population

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Introduction: The main components of routine audiological test battery are pure tone audiometry as well as immittance audiometry. The purpose of the present study was to find the correlation between acoustic reflex threshold (ART) and pure tone threshold (PTA) in normal adults.

Method: Thirty subjects in the age range of 20 to 25 years with normal hearing sensitivity were selected with equal number of both the genders. All the participants underwent otoscopic examination, Weber test and tympanometry which revealed to be normal. All the subjects with otological symptoms, hearing loss and neurological symptoms were excluded from the study. Modified Hughson Westlake (1959) procedure was followed using pure tone stimulus in calibrated GSI-61 Audiometer. Ipsilateral ART was taken in calibrated GSI Tymstar middle ear analyzer, using a probe stimulus to monitor admittance changes elicited by a reflex-activating stimulus. Subjects were asked to be seated in a well illuminated sound treated audiometric room. Calibrated headphone TDH-49 was used and pure tone average was calculated using the modified Hughson Westlake procedure. Frequencies measured were 250Hz, 500Hz, 1 KHz, 2 KHz, 4 KHz and 8 KHz. All the subjects' tympanograms revealed to be type 'A'. ART was measured in frequencies 500Hz, 1 KHz, 2 KHz, and 4 KHz.

Results: The statistical evaluation revealed that the lower limit is 68.62 in right ear and 71.60 in left ear. The upper limit is 90.11 in right ear and 87.52 in left ear, i.e. approximately 70-90 dB HL in both the ear. There is a slight difference between the thresholds of right and left ear.

Discussion: PTA and ART findings are correlating according to the theoretical norms.

Conclusion: Co-relation between acoustic reflex thresholds and pure tone thresholds for tones in subjects with normal hearing and normal middle ear function are 70-90 dB HL.

Key words: pure tone threshold, acoustic reflex threshold, immittance, middle ear

Sensitivity of short increment sensitivity index test in detecting cochlear pathology

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Introduction: Short increment sensitivity index (SISI) is widely used clinically to detect cochlear pathology. Patients with cochlear pathology will be able to appreciate even the small changes in intensity better due to the phenomenon of recruitment. SISI is performed by presenting a pure tone at a sound level of 20dBsl in which short increments are superimposed at periodic intervals where the size of the increments varies from 5-1dB. Theoretically, individuals with cochlear pathology has the ability to detect 1dB increments whereas normal individuals, conductive as well as retro-cochlear pathologic patients cannot detect. The aim of the present study was to examine the sensitivity of SISI in identifying cochlear pathology

Method: 60 subjects with cochlear pathology with the degree of moderate to severe hearing loss were included in the study. All the patients exhibited the presence of recruitment which was confirmed using Metz recruitment test. Subjects with conductive symptoms, neurological symptoms and psychological symptoms were excluded from the study. Subjects were seated comfortably in a well illuminated sound treated room and short increment sensitivity index test was performed at 500hz, 1khz & 2khz by using GSI 61 audiometer.

Results: Less than 40% of cochlear pathologic patients detected the 1dB increments in all test frequencies.

Discussion: All the participants included in the study were expected to detect the 1 dB increments but the results were contradicting with the hypothesis suggesting SISI is less sensitive in determining the presence of recruitment.

Conclusion: Since the sensitivity of SISI is not adequate for determining cochlear pathology, there is a need of outdating the tests like SISI and replacing other behavioral as well as electrophysiological tests for the differential diagnosis.

Key words: short increment sensitivity index test, cochlear pathology, recruitment, sensitivity, special test

Effects of Meditation Experience on Auditory Evoked Cognitive Potentials (P300 and MMN)

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Introduction: Meditation refers to a number of different practices in which a person practice or trains their mind or induces an inward focus. The idea is to exclude outside distractions. Many radiological and behavioral testing has been conducted on the individuals with meditation experience and have shown significant results on the structural and functional aspects at the central level. This study focused on comparison of cognitive potentials (MMN and P300) in individuals with no experience of meditation and individuals who are regularly practicing meditation with different years of experience.

Method: A total of 25 individuals participated in the study. Ten individuals (Mean age = 26.5) had no experience of meditation, 7 individuals (Mean age= 28.4) had less than one year of mediation experience and 8 individuals (Mean age= 28.1) had meditation experience of more than a year. All individuals had hearing thresholds within normal limits. All subjects were tested with P300 (/l/ as frequent and /i/ as infrequent) and MMN (/b/ as frequent and /p/ as infrequent).

Results: The obtained data were subjected to statistical analysis using SPSS software (version 20) and MANOVA was performed to assess the difference in P300 and MMN latency and amplitude between the three groups. Results showed that meditation group showed significant differences in P300 amplitude and MMN amplitude and area compared to control group. Also, The individuals with more years of meditation experience showed significant difference than the individuals with lesser experience in P300 amplitude and MMN amplitude and area. Thus, it can be inferred from the results that the individuals with more experience of meditation had better pre attentive and memory skills.

Conclusion: To conclude, the individuals who practice meditation has better pre attentive skills and better memory compared to individuals with no experience and these cognitive abilities improve with long term practice of meditation, which is reflected by P300 and MMN tests. However, data need to be collected on large group of population for better generalization of the study.

Key words: Meditation, Pre attentive skills, Memory

Effects of Physical Activity on Auditory Evoked Cognitive Potentials (P300 and MMN)

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Introduction: The General Practice Physical Activity Questionnaire was commissioned by the Department of Health and developed by the London School of Hygiene and Tropical Medicine as a validated short measure of physical activity (GPPAQ). It is used to divide the individuals with more physical activity and lesser physical activities. It calculates the physical activity index and divides the individuals into four groups such as active, moderately active, moderately inactive and inactive. The present study was conducted to compare the auditory evoked cognitive potentials (MMN & P300) in individuals with different degree of physical activity.

Method: A total of 28 normal hearing individuals were taken for MMN testing and 36 normal hearing individuals were taken for P300 testing. The age range of the participants was between 20-40 years. The participants were divided into four group i.e, active, moderately active, moderately inactive and inactive using GPPAQ which is validated tool to assess the physical activity of individuals. All subjects were tested with P300 (with /l/ as frequent and /i/ as infrequent) and MMN (with /b/ as frequent and /p/ as infrequent).

Results: The obtained data were subjected to statistical analysis using SPSS software (version 20) and MANOVA was administered. The results showed that amplitude of MMN and P300 was significantly higher for active and moderately active groups compared to physically inactive group.

Conclusion: Individuals who are physically active have better pre attentive skills and memory skills compared to inactive individuals.

Keywords: GPPAQ, PAI, Pre Attentive Skills, Memory

Evaluation of digital noise reduction algorithm in hearing aids with wireless synchronization technology

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Introduction: Studies have shown that digital noise reduction (DNR) algorithm plays a significant role in speech perception in noise. Manufacturers claim that DNR in wireless synchronization hearing aids tends to perform better. It is important to scientifically evaluate such claims. Hence, the present study aimed to evaluate the efficacy of DNR in hearing aids with wireless synchronization.

Method: The study included 25 listeners (age range of 27-55 years) with bilateral mild to moderate flat sensorineural hearing loss. Two hearing aids with wireless technology were fitted in both the ears. SNR-50 (SNR that was required to achieve 50% correct identification of speech) was obtained with and without DNR and wireless synchronization options. Standardized sentences in Kannada language were presented through a speaker at an angle of 0° for obtaining SNR-50. Speech babble (noise) was routed through four speaker sat 0°, 90°, 270° and in both 90° and 270° at a fixed presentation level of 70 dB SPL. The level of speech was varied till SNR-50 was achieved.

Results and discussion: The mean SNR-50 ranged from + 4.2 dB to + 7.6 dB. The lower is the SNR-50 better is the speech perception in noise. The results of Friedman test and Wilcoxon signed rank revealed that there was a significant improvement (3-4 dB) in SNR-50 using the wireless synchronization hearing aids. However, the results depended the location of noise source. When the speech and noise originated from 0°, the SNR-50 was higher irrespective of the presence or absence of DNR and wireless options. This is because it is difficult for the DNR algorithms to separate these signals due to lack of spatial cues. When the noise originated from 90°, 270° and from both 90° & 270°, lowest SNR-50 was found for conditions 'wireless synchronization was on DNR on' followed by 'only wireless on'.

Conclusion: It can be concluded that activation of DNR along with wireless synchronization option significantly improved the speech perception in noise in individuals with hearing impairment. It can be also concluded that when noise originates from 90° or 270°, DNR worked better.

Key words: DNR, Wireless, hearing aids, SNR-50

Temporal resolution and pattern processing abilities in children with dyslexia

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Introduction: Central auditory processing is defined as the perceptual processing of auditory information in the central nervous system and the neurobiological activity that underlies processing. Temporal resolution and pattern processing deficits are one of the sub-types of temporal processing domains. However, there is dearth of information to explore the children with dyslexia having temporal processing deficit. Hence, present study aimed to assess temporal resolution and pattern processing in children with dyslexia and compared with typically developing children.

Method: There were 10 children with dyslexia (clinical group) and 10 age matched typically developing children (control group) in the age range of 8-12 years participated for the study. The diagnosis of dyslexia was made by Clinical Psychologist/Speech Language Pathologist. All the participants had normal peripheral hearing sensitivity. For the pattern processing test, 1000 Hz pure tone of 250 ms (short) and 500 ms (long) duration was used in different combination for assessing pattern processing. For temporal resolution task, stimulus of 300 ms noise burst duration separated by a silence of 750 ms used in which gap was inserted in one of the segment. Both the psychoacoustic measures were done using Piano diagnostic audiometer with TDH-39 headphones at an intensity level of 40 dB SL (re:PTA) binaurally.

Result and Discussion: The collected data were analyzed using SPSS (Version 18). Descriptive statistics were done to find out mean and standard deviation and independent t-test was done to compare between control and clinical group. Descriptive statistics show the mean of temporal resolution as well as pattern processing was higher (poorer) in children with dyslexia in comparison to typically developing children. Further, independent t-test shows significant differences between two groups for both temporal resolution ($t = -16.25$, $df = 18$, $p = 0.001$, one tailed) as well as pattern processing abilities ($t = 9.05$, $df = 18$, $p = 0.001$, one tailed) in dyslexic children. Hence, the present study showed children with dyslexia are having poor temporal resolution as well as pattern processing abilities, which is an important domain in day to day life.

Conclusion: Present study concludes that dyslexic children showed reduced temporal resolution and pattern processing abilities in comparison to typically developing children.

Development And Standardization Of Phonological Awareness In Bangla Between Hearing Children And Children Using Cochlear Implant

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Introduction: Phonological awareness is the ability to reflect on and manipulate the constituent segment of spoken words. The study included groups of participants to perform different tasks needed for development and standardization of spondee list.

Methods: Ten audiologist and speech language pathologist were needed for judgment of equal stress on bisyllabic words. 150 adult native Bengali speakers ($n_m=75$, $n_f=75$) were needed for familiarization. 10 normal hearing (pure tone thresholds within 25dBHL at octave frequencies of 250 Hz to 8000Hz) Bengali adults with no history of any ear discharge were included in the study. 30 normal hearing were included for the study. Bengali bisyllabic words as many as possible were collected from Bengali story books, news papers, magazines, periodicals and text books of West Bengal Board of Secondary and Higher Secondary Education. The collected bisyllabic words were tabulated and given to 10 audiologists and speech language pathologist with an option of 'yes' or 'no', to judge equal stress. 0 words from the two lists were randomly presented to 10 normal hearing participants in both the ears at different intensity levels. The lowest intensity level was measured for 50% and 100% scores and highest intensity level for 0% scores of each word.

Results and Discussion: The present study found that the cochlear implant group and the hearing group had both similarities and differences in terms of their phonological awareness abilities. The cochlear implant group generally performed poorer than the hearing group on phonological tasks. Due to auditory deficits, children with cochlear implants were suspected to have impaired phonological awareness abilities. Age might be a major factor to develop the phonological skills. Researchers suggested that children with early cochlear implantation would be able to show comparable performance on their expressive language abilities and their speech production as their hearing peers in later years (Nicholas & Geers, 2007; Flipsen, 2008).

Conclusions: Findings of the study will assist to find out the area of phonological awareness where children using cochlear implant faced difficulties and to develop new strategies for developing the phonological awareness skill.

Development and Standardization of Spondee Words in Bengali

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Introduction: Hearing loss is the primary cause that creates communication problem in day to day life irrespective of type and degree of loss. An audiologist spends considerable time using speech audiometric procedure that provides unique information. Clinical speech audiometry was developed from a need to quantify this ability. The most commonly employed and recommended speech stimuli for speech recognition testing are spondaic words (ASHA, 1979, 1988; Wilson and Margolis, 1989). Perception is a process whereby an utterance is decoded into a presentation in terms of linguistic unit. The way speech sounds are perceived by the listener also depends on acoustic and physiologic factors. The determination of speech recognition threshold involves the basic procedure that consist of instructions, familiarization, a single series of descending threshold determination and calculation of threshold hearing level. The three frequency of the pure tone air conduction threshold at 500, 1000 and 2000Hz is good prediction of the SRT in patients with relatively flat hearing loss.

Methods: A large number of Bengali bisyllabic words excluding rhyming and reduplicated words were collected and a perceptual analysis was done by audiologists to identify the words that can be presented with equal stress on both the syllable between too easy and too difficult word list. 41 words between them were selected to prepare final two spondee word lists. Each list contains 20 words and total familiarity weightage were very near to each other the homogeneity with respect to audibility were judged by obtaining lowest level for 0%, 50% and 100% intelligibility of each spondee. The developed spondee was standardized on 30 normal hearing adult native.

Discussion and Conclusion: The study shows that SRT with developed spondee word list will be within 25 dBHL for normal hearing population and SRT-PTA agreement was greater or less than 6 dB. The development of Bengali spondee word list followed and fulfilled all the criterion of spondee words and developed Bengali spondee was standardized to serve the clinical purpose for Bengali population.

Development and standardization of phonemically balanced word lists in Bengali

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Introduction: Speech audiometry is an essential component in the battery of audiological tests battery. The plethora of research studies advocates that during speech audiometry an individual needs to be tested in his or her own native language. The present study aimed to develop two 50 item word list in Bengali spoken colloquially; that exhibited familiarity, homogeneity and phonemic balance.

Methods: The study also aimed to develop four word lists with 25 items from the parent list. In order to achieve familiarity of the test material 299 most familiar words were selected from two sources. This pool of 299 words was subjected to familiarity testing by 5 native speakers. Standardization of the test material was done on 30 native normal hearing subjects. Test retest reliability was assessed by presenting the test material after one week. Validity measures were obtained by presenting the CID W-22 lists to 30 native speakers of Bengali who were also proficient in English and then comparing the derived scores.

Results and discussions: Half list were developed by arranging the words of each list from most difficult to easiest and then splitting the list into half to obtain two 25 items list from each parent list. The slopes of the mean psychometric functions for wordlist 1 and 2 were 3.5%/dB and 3.6%/ dB respectively. The homogeneity of the word lists was examined by evaluating the interlist equivalence, interword variability and intersubject variability. The interword and intersubject variability for both the list was 4.3dB and 4.5 dB; and 3.5 dB and 3.4 dB respectively. Binomial Probability confirmed that the two lists were essentially equivalent at all presentation level. The result of the test for equality of Binomial Probability also established that there is no significant difference between the scores of CID W – 22 and the developed wordlists.

Conclusions: Based on the above findings it can be concluded that the material can be used to assess word recognition scores for the native Bengali speakers.

Keywords: phonemic balance, psychometric functions, reliability, validity

Prevalence of tinnitus in hearing impaired individuals in a hospital setup

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Introduction: Tinnitus refers to perception of sound in ears or head in the absence of any external sound. People with tinnitus may suffer from frequent mood swings, anxiety attacks, tension, frustration, poor concentration, and sleep problems. In USA, 10% to 26.7% of population suffered with tinnitus (Kochkin, 2011) and for older population prevalence varied from 12 to 30 % (Seidman, 1996; Shargorodsky, 2010). Shrestham (2012) found 11% of outpatients in a general hospital in Nepal had a history of tinnitus. For Indian population, there is very limited information available for this. Kumaran (2014) reported 16.81% prevalence of tinnitus among geriatrics population with otological problems. Therefore, this study was taken up to find out prevalence of tinnitus among the individuals with hearing impairment. This information may help us understand the nature and progression of tinnitus develop appropriate interventions and prevention strategies.

Methods: Retrospective study design was used. Age, hearing thresholds, presence or absence of tinnitus was recorded for each client who had visited to the audiology department of SRM Medical College Hospital and Research Centre (SRM MCH&RC), during the period of March 2014 to February 2015. Descriptive statistics were carried out. Institutional Ethical Committee of SRM MCH&RC has approved this study.

Results and Discussion: There was no ear preference for tinnitus. Prevalence of normal hearing in tinnitus subjects were 22.17% (Right Ear) and 18.88% (Left Ear) whereas Kumaran (2014) found 2.5%. This may be due to their aged study sample. Among all the hearing impaired individuals (HI) prevalence of tinnitus were 29.06% (RE) and 26.33% (LE). This agrees with others findings of higher prevalence in HI. There was a trend of increment in prevalence of tinnitus from mild to severe degree of hearing loss. Tinnitus was maximally prevalent in sensorineural hearing loss (40 and 45%) in comparison to other types of loss.

Conclusion: Our study showed an association between tinnitus and degrees of hearing loss in HI. In view of insufficient prevalence data for tinnitus especially for Indian and south Asia population, this study's significance is more. However, as it is not a population based survey, this data should be considered with precaution.

Keywords: Tinnitus, Prevalence, Normal Hearing, Hearing Impairment

Audiogram patterns associated with tinnitus- a retrospective case study

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Introduction: Tinnitus is perception of sound in ears/ head in the absence of any external sound. Elevated hearing thresholds and steep audiograms have been associated with tinnitus (Roberts et al., 2008; Konig et al., 2006). However, Barnea (1990), showed no significant differences between subjects with and without tinnitus. Recent findings indicate deafferentation of certain nerve fibres can lead to tinnitus with normal hearing (Kujawa and Liberman 2009; Schaette, 2011). Tan et al., (2013) reported that tinnitus patients had specific inner ear damage which triggered tinnitus. Hence, in the context of these recent evidences and unsettled findings, this study aims to find out if subjects with tinnitus do exhibit any specific audiogram pattern. This information will be useful in better understanding tinnitus and providing management.

Methods: Case details of 1610 individuals, who had reported to the Dept. of Audiology and Speech-Language Pathology, SRM MCH&RC between March-2014 and February-2015, were reviewed. Age, hearing threshold, presence/ absence of tinnitus were recorded and analyzed.

Results and discussion: Mean hearing thresholds were plotted and gradual sloping audiograms were observed for both normal hearing (NH) and hearing impaired (HI) groups with tinnitus. Analysis to rule out effect of age related changes revealed the same information. There was a tendency of higher thresholds at high frequencies in subjects with tinnitus. However, significant differences were observed only at 8000 Hz for NH and at 4000 Hz for HI subjects. These findings contradict Barnea (1990)'s findings of no significant differences. However, our findings correlate with Tan et al., (2013) and Konig et al., 2006). Tan et al., (2013) reported high prevalence of high frequency hearing loss in subjects with tinnitus. They attributed this to possible inner hair cell damage.

Conclusion: Our study showed higher prevalence of sloping pattern audiogram for subjects with tinnitus. However, audiogram alone couldn't predict the probability of tinnitus. In future, we hope audiogram along with other psychophysical and electrophysiological test profiles would be able to find out if there is any particular pattern associated with tinnitus, hence helping in better understanding of the condition.

Keywords: Tinnitus, audiogram pattern, hearing impairment, normal hearing.

Diabetes Mellitus and Hearing Loss

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Introduction: Diabetes mellitus is a condition when either the sugar level increases in blood due to reduced insulin or the body become resistant to its normal effect. Diabetes affects the functioning of the auditory nerve which ultimately affects the hearing ability. Recent studies depicts the ratio of hearing impairment in diabetic people to that in normal people. It is possible that high blood glucose level associated with diabetes cause damage to small blood vessels in the inner ear, similar to the way diabetes cause damage to the eyes and kidney. Hence, it can be assumed that diabetes may affect hearing.

Need for Study: This study is aimed to determine if hearing loss is associated with sugar levels.

Method: Pure tone audiometer was performed on 25 subjects. Their history of diabetes which includes the onset duration, initial and current blood sugar level were noted. They were assessed by otoscopic examination and pure tone audiometry. A verbal consent from the participants was obtained. All the information collected from the subjects was tabulated. The data was analysed using SPSS (version 20)

Result and Discussions: Most the participants had mild to moderate hearing loss. Two subjects had moderately severe hearing loss. All the subjects had sensorineural type of hearing loss. The co-relation between the blood sugar level and the hearing thresholds was significant ($r=0.99$, $p<0.01$). Age, hypertension and migraine were also found to influence hearing on eye balling. Even if the intensity of hearing loss is mild at initial stage, it can get even severe if left untreated.

Conclusions: The result of the present study suggests that diabetes mellitus affects hearing. Premature hearing loss, being associated with blood sugar level in diabetic patient, is an alarming situation for the audiologists to track and critically evaluate the evidence of hearing loss in diabetic patient.

Keywords: Diabetes mellitus, Pure Tone Audiometry, Blood Sugar Level, Hearing loss

Association of blood pressure and diabetic mellitus with sudden hearing loss

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Introduction: Sudden hearing loss (SHL) is defined as greater than 30 dB hearing reduction, over at least three contiguous frequencies, occurring over a period of 72 hours or less (American Hearing Research Foundation, 2012). The incidence of SHL has been reported to be 5-30 per 100,000 person per year (Zarenue et al, 2007) and accounts for 1% of all sensorineural hearing loss cases (Hughes et al 1996). Duck et al, (2009) investigated interactions between diabetic mellitus (DM) and auditory function in both clinical and animal studies. Insulin-dependent diabetes and hypertension were found to have a synergistic effect on high-frequency hearing loss. Diabetic end-organ damage was intensified by concomitant blood pressure. Arterial hypertension has also been associated with SHL. Unlike other hearing impairment condition SHL is a clinical challenge. The cause of SHL may be multifactorial. Understanding of the cause is very important to develop any treatment strategies and prognosis. In addition to this there is dearth of literature on SHL for Indian population. Hence, this study is taken up. In this study, we aim to find out any association between SHL and BP and DM in a multi-speciality tertiary hospital set up.

Methodology: Retrospective study design was used. Age, hearing thresholds, presence or absence of blood pressure (BP), DM were recorded for each client who had visited to the audiology department of SRM MCH&RC, during the period of March 2010 to February 2015. Descriptive statistics and chi square test were carried out.

Results and Discussion: The prevalence of SHL was 15.53%. There was no significance difference between right and left ear. There was higher prevalence of SHL among males. Chi-square test revealed BP ($p < 0.01$) and DM ($p < 0.01$) has association with SHL which agrees with (Duck, 2009).

Conclusion: Our study showed an association between BP, DM with SHL. Such association between hearing loss and arterial hypertension (Smita K. Nagle, 2009). In view of insufficient data for SHL especially for Indian, this study's significance is more. However, as it is not a population based survey, this data should be considered with precaution.

Key words: Diabetic mellitus, blood pressure, sudden hearing loss

Development of normative compliance values in a multispeciality hospital in Tamil Nadu

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Introduction: Compliance measurement (tympanometry) is very important to rule out middle ear pathology to decide treatment strategies. Shanks and Shohet (2009) compiled a list of large scale studies of normative ranges and gave the 90% range for a normal compliance value as 0.2 to 1.8 cc. This compliance values depends on middle ear pressure and atmospheric pressure. We know atmospheric pressure varies because of humidity and height from sea level. However, only a few clinics may have their own normative value in India leading to misdiagnosis and serious complications. Also, fewer studies have discussed normative data for Indian population. Therefore, in this study we aim (1) to ascertain the importance of clinic specific normative data for compliance measurement and (2) to develop a normative compliance range for an audiology clinic.

Methodology: Case details of 890 individuals (Age:18yrs-70yrs), who had reported to the Audiology Clinic of SRM MCH&RC, were reviewed. Detailed findings of tympanometry, hearing thresholds, otolaryngologists' report were recorded. Air conduction and bone conduction thresholds were compared (ABg). This value were verified with otolaryngologists' report to establish normal middle ear functioning. 90th percentile values were calculated and Receiver Operating Curves (ROC) were obtained to establish a new set of normative values.

Results and Discussion: For the data from our clinic with normal middle ear functioning, we found that 90th percentile people fall in 0.2 to 2.47cc value which was different from other reported values. This value indicated that in our clinic we could misdiagnose a significant 4% population if we would have used 0.2 to 1.8cc reported earlier (Shanks and Shohet, 2009).

Conclusion: In our study, we found that 90% of population in our clinic who had normal middle ear functioning had compliance values from 0.2 to 2.47cc. This data showed that adaptation of normative data developed on a different population and geographical location may lead to misdiagnosis. This data ascertain the need to develop clinic specific normative range for compliance value. However, as this is a retrospective analysis, these normative values may not be accurate. Further, detailed experiments should be carried out to establish normative data for Indian population.

Keywords: Normative, Tympanometry, ABg, Compliance.

Brainstem Evoked Response Audiometry (BERA) findings in Inflammatory Brain Diseases and Cerebral Malaria

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Introduction:

Inflammatory brain diseases like tuberculous meningitis, pyogenic meningitis and viral meningoencephalitis are the major cause of morbidity and mortality in children, as well as are well known etiology of sensory neural hearing loss. Cerebral malaria is not a very well known cause of hearing loss but still it can lead to rapid deterioration of hearing by damaging hearing pathway. Deafness is the most common of all forms of permanent damage following meningitis, affecting as many as 10 % of all children who recover (Tarlow 1997). The aim of the study was to assess the prevalence of hearing impairment in patients suffering from inflammatory brain diseases and cerebral malaria and infer the pathological site of auditory pathway in these patients.

Methodology: Total of 39 children of age group 0-16 years with clinical features suggestive of the diseases, were included. Another 10 otherwise healthy children were tested to establish base line findings. The subjects were divided into- Group I: Tuberculous Meningitis (n=16), Group II: Non-Tuberculous Meningitis (Bacterial Meningitis and Viral meningoencephalitis) (n=16), Group III: Cerebral malaria (n=7). Different cytological, biochemical, radiological examinations and microscopy were performed. The patients were monitored for fever, level of consciousness, azotemia, and jaundice. Otological and audiological evaluation including Brain stem evoked response audiometry, were done.

Results and Discussion: Hearing loss as a complaint was present in 37.5% of cases in group-I, 37.5% of cases in group-II & 28.6% of cases in group-III. Many studies shows similar results showing hearing loss ranging between 20-60% cases. The latency and amplitude of 1st, 3rd and 5th wave, were noted and analyzed for any significant difference in groups, or than normal subjects.

Summary & Conclusion: Hearing loss was not a major presenting symptom, but on assessment, 35.9% cases had hearing loss, 30.7% cases had sensorineural hearing loss and mostly of bilateral type. In cerebral malaria cases, significant difference was noted in interpeak latency of wave I-V and III-V and latency of wave-III and wave-V.

Key words: Brainstem evoked response audiometry, Inflammatory Brain Diseases and Cerebral Malaria

Hearing loss in pre-diabetic & type 2 diabetic patients in Rural areas of Telangana.

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Introduction:

Diabetes mellitus type 2 or noninsulin-dependent diabetes mellitus (NIDDM) makes up about 90% of cases, progressed from the stage of impaired fasting glucose (IFG) or pre-diabetes. Number of cases, globally, increased markedly over 50 years, in parallel with obesity; with India, having largest number of 50.8 million. Classic symptoms includes polyuria, polydipsia, polyphagia, weight loss, acanthosisnigricans, frequent infections, peripheral neuropathy like blurred vision to nontraumatic blindness and fatigue; also cardiovascular disease, stroke, kidney failure, and increased risk of cognitive dysfunction. In terms of hearing mechanism, it causes diffuse thickness of basal membrane and microangiopathy, secondary degeneration of 8th cranial nerve; also changes in central auditory processing (Leon-Morales et al., 2005), evidenced by histopathological findings (Makishima & Tanaka, 1971). There are many studies, globally, showing direct relation of prevalent hearing loss and prolonged period of diabetes, also indicates importance of early recognition of chronic complications like hearing loss. This study was aimed at comparing auditory acuity of type 2 diabetics and pre-diabetic subjects, and other factors associated with it.

Methodology: A cross-sectional case study included a total of 600 subjects (300 type 2 diabetic and 300 pre-diabetic). Outcome hearing profile included pure tone audiometry, oto acoustic emissions, impedance audiometry including reflexometry and brainstem responses. Prevalence (proportion) was calculated for people with hearing loss with T2DM, based on gender, age and duration of the disease. Other tests included peripheral neuropathy assessment using clinical scoring system (Diabetic Neuropathy Symptom Score-DNS).

Results: The details of the findings are clearly evident of complete hearing profile may indicate early signs of changes in hearing mechanism due to T2DM. Scores from DNS are analyzed and seen to be significantly altered in these pre-diabetic rural patients.

Conclusion: The pre-diabetic subjects should, not only undergo mandatory hearing, but also assessment of other parts of the body as to know generated effect. Findings from the objective evaluation may be used as indicators for early diagnosis to help in counseling and possible effective intervention.

Key Words: Hearing loss, pre-diabetic, type 2 diabetic, Indicators, rural.

Perspectives and attitudes of occupational noise exposed persons towards the risk of noise induced hearing loss

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Introduction: Noise is a prevalent occupational hazard which damages the auditory system and induces hearing impairment whose severity varies among individuals. Noise Induced Hearing Loss (NIHL) and Noise Induced Tinnitus (NIT) can negatively affect personal safety and quality of life for affected noise exposed individuals (Berger, 2000). This study aims to evaluate the attitudes, beliefs and behavioral intentions of industrial on site workers and traffic police personnels regarding NIHL, NIT and fitting, use and maintenance of HPD in their workplaces.

Method: 40 male factory workers (Group A: From 5 Delhi based Industries) and 40 male traffic police personnel (Group B: Delhi Traffic Police) between 30-50 years were included for the study. Detailed case history followed by audiometric test battery was done. All subjects were given to fill a validated Questionnaire BAHPHL (Beliefs about hearing protection and hearing loss) (NOISH) consisting of 36 items including 5 questions relating to NIT. Noise levels of the working environment were measured at all the working sites.

Result: 92.5% & 52.5% of respective group GrA & Gr B did not intend to wear HPD during working hours, nor were they provided for the same. Worse to find 52.5% and 90% of respective groups had no information that prolonged noise exposure can lead to progressive NIHL. NIT was reported by 20% & 35% of both groups respectively. Discomfort, ear itching, sweat were some of the major causes of disapproving the use of HPD.

Discussion: Study showed the unawareness and lack of concern among subjects relating to NIHL, NIT and the use of HPD's. Despite the high risk of noise induced irreversible progressive hearing loss and tinnitus subject were not much keen to adopt the safety measures for hearing protection while on duty. Also, the private sector employers too are least concerned to educate their factory workers regarding these health related issues.

Conclusion: Employers need to take stern steps for the workers overall health safety. Routine hearing checkups and orientation regarding use and maintenance of HPD should be done. Noise monitoring of the working site and provision of adequate HPD to be done on regular basis.

Key Words: Occupational noise, Noise Induced Hearing Loss, Noise Induced tinnitus, Hearing protection device.

Speech Recognition Performance of Adults: A Proposal for a Battery for Marathi

S. B. Rathna Kumar, Pranjali A Ujwane & Panchanan Mohanty

Introduction: The present study aimed to develop a battery for assessing speech recognition performance by adults in Marathi.

Methods: A total of four word lists were developed by considering word frequency, word familiarity, words in common use, and phonemic balance. Each word list consists of 25 words (15 monosyllabic words in CVC structure and 10 disyllabic words in CVCV structure). Equivalence analysis and performance-intensity function testing was carried using the four word lists on a total of 150 native speakers of Marathi belonging to different regions of Maharashtra (Vidarbha, Marathwada, Khandesh and Northern Maharashtra, Pune, and Konkan). The subjects were further equally divided into five groups based on above mentioned regions.

Results and Discussion: It was found that there was no significant difference ($p > 0.05$) in the speech recognition performance between groups for each word list and between word lists for each group. Hence, the four word lists developed were equally difficult for all the groups and can be used interchangeably. The performance-intensity (PI) function curve showed semi-linear function, and the groups' mean slope of the linear portions of the curve indicated an average linear slope of 4.64%, 4.73%, 4.68% and 4.85% increase in word recognition score per dB for list 1, list 2, list 3 and list 4 respectively. Although, there is no data available on speech recognition tests for adults in Marathi, most of the findings of the study are in line with the findings of research reports on other languages.

Conclusions: The four word lists, thus developed, were found to have sufficient reliability and validity in assessing speech recognition performance by adults in Marathi.

Keywords: speech recognition performance, phonemic balance, equivalence analysis, performance-intensity function testing, reliability, validity

Speech Perception by Monolingual and Bilingual Dravidian Speakers under Adverse Listening Conditions

S. B. Rathna Kumar, Sale Kranthi & Sandya K Varudhini

Introduction: The precise perception of spoken language is influenced by several variables, including the listeners' native language, distance between speaker and listener, reverberation and background noise. When noise is present in an acoustic environment, it masks the speech signal resulting in reduction in the redundancy of the acoustic and linguistic cues of speech. There is strong evidence that bilinguals face difficulty in speech perception for their second language compared with monolingual speakers under adverse listening conditions such as presence of background noise. This difficulty persists even for speakers who are highly proficient in their second language and is greater in those who have learned the second language later in life.

Methods: The present study aimed to assess the performance of monolingual (Telugu speaking) and bilingual (Tamil as first language and Telugu as second language) speakers on Telugu speech perception task under quiet and noisy environments.

Results and Discussions: The results indicated that both the groups performed similar in both quiet and noisy environments. The findings of the present study are not in accordance with the findings of previous studies which strongly report poorer speech perception in adverse listening conditions such as noise with bilingual speakers for their second language compared with monolinguals.

Keywords: monolingual, bilingual, second language, speech perception, quiet, noise

Hearing Aid Induced Plasticity in the Auditory System of the Elderly: Evidence from Speech Perception

Chitti Reddy Raju, Aparna Ravichandran, Sale Kranthi & S. B. Rathna Kumar

Introduction: Auditory rehabilitation is to a great degree dependent on the brain's capacity to change once an audible signal is presented to the brain. People with the same type and degree of hearing loss often perform quite differently with regard to understanding speech even while using similar hearing aids attributed to differences in age and their individual responses to auditory deprivation and stimulation (Tremblay & Moore, 2012). Although the reasons for these speech understanding difficulties in elderly population are not fully understood (Martin and Jerger, 2005; Wingfield, Tun, & McCoy, 2005), they are often cited for seeking rehabilitation in the form of hearing aids which can lead to acclimatization (Gatehouse, 1993; Robinson & Summerfield, 1996).

Need & Aim of the Study: Nevertheless, a number of studies failed to find evidence for acclimatization to hearing aids (Humes & Wilson, 2003) or showed only small gains in performance over time (Kalluri & Edwards, 2014). Of significant importance, Tremblay and Moore essentially state with regard to hearing aid fittings and acclimatization, in the absence of targeted therapy over time (i.e., auditory training) "noted changes in audibility related to hearing aid gain." Hence the current study was aimed to establish whether hearing aid use can induce plastic changes in auditory perceptual functions (pre – test, 3 months and 6 months) by using speech identification in noise, in elderly hearing-impaired population

Method: 90 elderly hearing-impaired listeners across the age range of 50 to 80 years categorized into three groups depending on degree of sensorineural hearing loss (moderate to moderately severe, moderately severe to severe and severe to profound) were evaluated using Speech in Noise Test material (SPIN) mixed with broadband noise developed by Kumar & Mohanty (2012) under three conditions +10, quiet and -10 and raw score were analyzed.

Discussion: Results have shown a significant changes in hearing aid benefit over time period of more than 5 months hearing aid usage especially in +10dB conditions. Using a speech-in noise test (word identification) and the benefits of the prescription were not evident upon immediate testing but became statistically significant and of clinical magnitude following experience with the prescription for greater than 5 months which was concurrent with studies on plasticity which have suggested that increased auditory stimulation because of amplification may induce plasticity, which facilitates acclimatization (Willot, 1996 & Amorim et.al, 2007).

Conclusion: Habilitation and/or rehabilitation professionals working with patients with hearing loss need to understand plasticity in the auditory system, and consider it an important clinical tool. Future studies will be very helpful to add knowledge about plasticity in the auditory system.

Effect of Monoaural and Bimodal Stimulation on Temporal Resolution in Children with Cochlear Implant

S. B. Rathna Kumar, Sale Kranthi & Sandhya K Varudhini

Introduction: The multichannel cochlear implants (CIs) are firmly established as effective options for the (re) habilitation of adults and children with bilateral profound hearing impairment. They are designed to take advantage of the tonotopic organization of the cochlea to encode spectral frequency cues. The incoming sound signal is filtered into frequency bands, each corresponding to a given electrode in the electrode array. Despite cochlear implants having presented significant advances for the past few decades, the current devices still do not restore normal perception of speech, especially in adverse situations such as presence of noise or many speakers at the same time. Studies have reported significant speech-recognition improvements for bimodal listening compared to either the subject's pre-operative bilateral hearing aid usage or their post-operative usage of cochlear implant alone in children and adults. This could be attributed to the reason that the residual acoustic hearing is often superior to electrically stimulated hearing. Frequency and temporal resolutions are relatively preserved in low frequency acoustic hearing even when the degree of hearing loss more.

Need for the Study: The benefits of bimodal hearing has been extensively studied, in terms of phoneme, word, and sentence recognition, both in quiet and in noisy listening conditions. Little research exists on benefits of bimodal hearing in terms temporal resolution using psychophysical methods. Hence, the current study attempts to study the effect of bimodal stimulation on temporal resolution in children with cochlear implant using Gap Detection Test.

Method: Gap Detection Test was administered on 22 children in the age range between 9 and 12 years with cochlear implant using bimodal stimulation. The Gap detection threshold were measured at 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz CI alone Condition and CI + HA Bimodal condition.

Results: The gap detection thresholds improved as the frequency increases under both monaural and bimodal listening conditions. However, the gap detection thresholds were poor at lower frequencies as compared to higher frequencies under CI alone condition as compared to CI+HA bimodal condition. Bimodal CI+HA listening condition resulted in improved gap detection threshold at low-frequencies. The better frequency and temporal resolution of the low-frequency residual acoustic hearing combined with electrical stimulation via cochlear implant likely account for this low-frequency advantage in CI+HA condition.

Conclusion: Temporal resolution is present in cochlear implant users. However poorer in low-frequencies compared to mid-and high-frequencies. The bimodal stimulation provides improved temporal resolution at low-frequencies as compared to CI alone condition.

Temporal Processing Ability in Visually Impaired Individuals

Sale Kranthi, Sandhya K Varudhini, Chitti Reddy Raju & Aparna Ravichandran

Background: One of the factors identified in psychoacoustic experiments as contributing to poor speech perception is the reduced temporal resolving power of the auditory system (Dreshler & Plomp, 1985; Aingel et al. 1982; Price & Simon, 1984; Schneider, 1997; Tyler et al 1982). The ability to perceive the order of sounds, discrimination between similar words and consonants which influences all aspects of speech, music, and general listening tasks. Temporal integration is a time –intensity trading relationship in which the intensity of a tone must be increased to obtain threshold when its duration falls below a critical minimum. Whereas, temporal resolution is the shortest perceptible time interval to the intensity and frequency difference limens. The tests for temporal resolution is gap detection in noise test in which the patient is asked to identify if one or two tones or clicks are heard. The stimuli are presented in random order making it a more challenging task.

Aim of the study: Main feature of auditory processing abilities is temporal processing including temporal resolution, temporal ordering, temporal integration and temporal masking. Many studies have shown the superiority of blinds in temporal discrimination over sighted subjects. In this study, temporal processing was compared in congenital blind subjects with sighted controls via Frequency Specific Gap Detection Test (GDT).

Methods: This study was conducted on 10 congenital blinds (5 males and 5 females) with a mean age of 26.22 years and 10 sighted control subjects (5 males and 5 females) with a mean age of 24.04 years with normal hearing. Gap Detection Test results, approximate threshold and percent of corrected answers, were obtained and then, were analyzed by Mann-Whitney non-parametric statistical test.

Results: There was a larger gap at low frequencies when compared with mid and high frequencies, this marked difference at low frequency is observed because the auditory filter seems to play a role in determining the form of the results for the standard-and reversed phase conditions, Gap thresholds estimated from the preserved-phase condition do not show a strong effect of center frequency, except at very low frequency (200 Hz below). It appears the range in the auditory filter, only limits gap detection for sin waves at very low center frequencies.

Conclusion: Auditory temporal resolution ability, in blind subjects is better than the sighted control group and it might be related to the compensative neuroplasticity after visual Deprivation and larger gap at low frequencies when compared with mid and high frequencies, this marked difference at low frequency is observed because the auditory filter seems to play arole in determining the form of the results for the standard-and reversed phase conditions, Gap thresholds estimated from the preserved-phase condition do not show a strong effect of center frequency, except at very low frequency (200 Hz below).

Keywords: Temporal Processing, Temporal Resolution, Gap Detection Test (GDT), Blindness, Neuroplasticity.

A Comparative Study of Vowel Length in Hindi and Nepali

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Introduction: This paper attempts to study variation in Nepali who speaks Hindi by examining the speech of Nepali speaker of Hindi. The acoustic characteristics of vowel length in Hindi words spoken by native and nonnative speakers of Hindi have been compared, by segmenting the words into syllables and phonemes.

Methods: Total 18 subjects were investigated and divided into two groups where 9 Nepali and 9 Hindi speakers of age group 18-30 year male. All native Hindi speakers were belongs to Uttar Pradesh and Nepali population who were exposed to Hindi language for a minimum of 4 year were taken. The normal occurring 9 vowels (/Y^/, /Q^/, /j^ /, /i/, /^/, /u/, /e/, /[^/, /o/) were chosen for the study.

Results and Discussion: we found that there is significance variation in vowel length in the words Anar, Alu, Rumal, Billi, Chini, Pani, Ungli, ullu, Kela, Einak, Pesa and Do. These all word have significant variation. Nepali and Hindi are in the same family and shares same script. Around 50% of the vowel are produced with similar duration that is there is not significant difference in vowel duration but 50% of the vowel are significant difference. The vowels which have significant difference are in the words /Y^nQ^r/, /Q^lu/, /rumQ^l/, /bj^llj^/, /c^ini/, /u^t/, /^llu/, /kelQ^/, /[^nak/, /p^sa/, / d*~O /.

Conclusions: We see the individual vowel all the vowel duration are significant difference.

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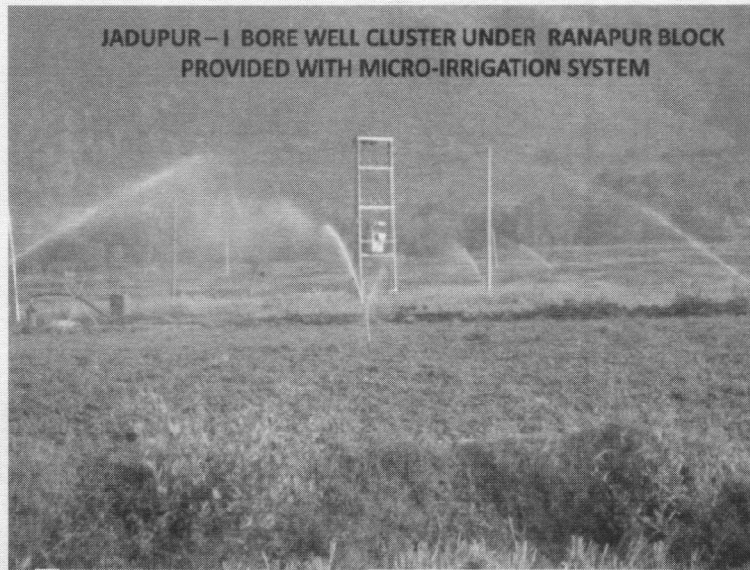
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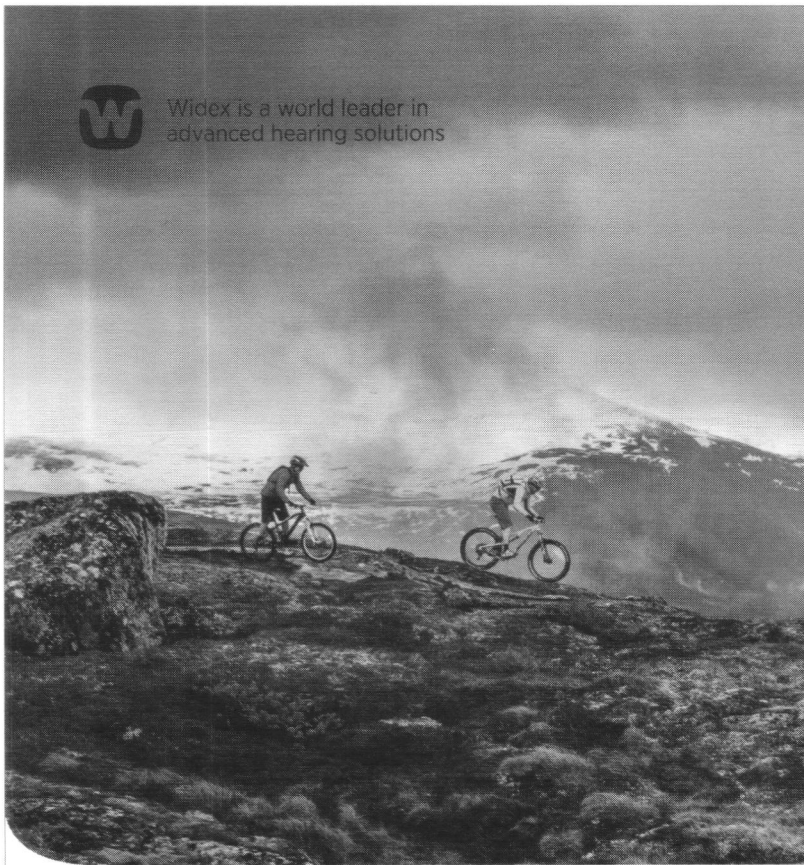
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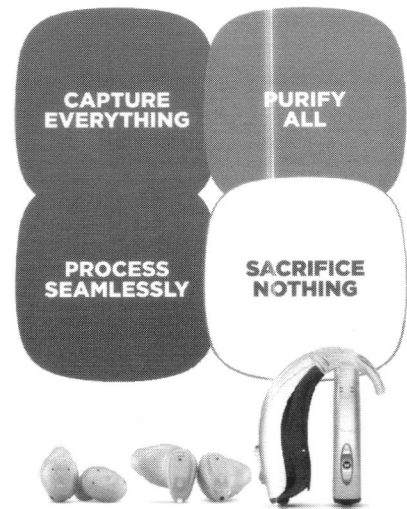
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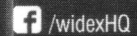
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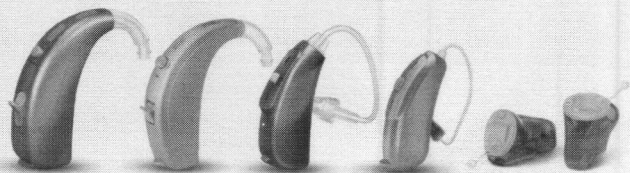


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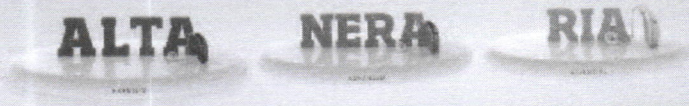
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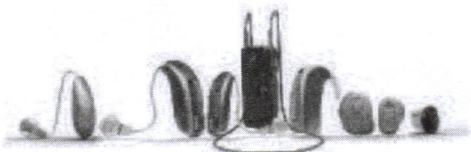
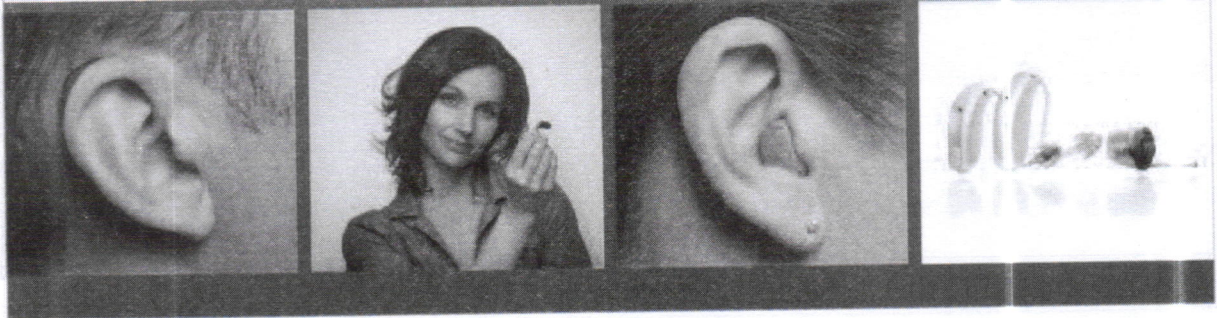
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