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Editorial

Since 2009 the ISAM Journal has gone ahead to fill a void of publication to showcase professional research in Audiology and Audio Vestibular Sciences in India. The success of 2022 edition of ISAM Journal makes me thrilled with pleasure as it comes at a time of the Pandemic. The gloom of Covid had overshadowed every domain of human activity as humanity tried to survive the pandemic. The adaptable human race learns from every misfortune, every calamity and every disaster. The challenge of social distancing made learning activities go online. Thus, the International Symposium on Audiological Medicine too was conducted in virtual mode with researchers making live presentation online. The success of the event was seen in international participation with resource persons from Japan, New Zealand, Singapore, India, Sweden, Denmark, UK and USA. This time, the focus was on cognitive hearing, neurophysiology of hearing, Neuro Otology and the challenges of modern times. The future of the profession is always paved by professionals themselves through innovative technology solutions. Responding to the changing reality should be the collective responsibility of all stakeholders. Academic establishment, researchers, clinical services, publishing platforms should sync to tap evidences to build future protocols. The ISAM Journal will continue to play its facilitating role of building the ecosystem "Where Ear meets Hearing "

Prof. Satya Mahapatra
Chief Editor

Dr. RAJENDRA KUMAR PORIKA, Ph.D.(ASLP), EDITOR ISAM-2022 Advisory Member to TASLPA, Audiologist & Speech Language Pathologist, AYJNISHD (D) RC Secunderabad, Hyderabad Telangana - 500009, INDIA. Email: rajindrakumarp@gmail.com, Mobile: +91 9849236299.

Editor's Message

I convey my sincere gratitude and thank the Chief Editor, Founder of ISAM Professor Satyanarayana Mahapatra Sir for the opportunity to be an Editor for this innovative Journal, ISAM-2022. I thank Dr. Nagender Kankipati, Hon' President & Dr. Imad Khan, Hon' Gen. Secretary and Team of Telangana Audiologists & Speech Language Pathologists Association for extending their kind support.

The Journal of International Symposium of Audiological Medicine (ISAM) is a great initiation for Research documentation. This innovative work brings compilation of the current, latest, upcoming and advanced audiological research works. This Journal primarily aims the dissemination of informative knowledge for the students, research scholars, Professionals, Practicing Audiologists & Speech Language Pathologists to gain and update their knowledge in Audiology stream. This also supports and encourages the research works, start-ups internationally in the area of Audiology.

It's my pleasure to thank all the Authors for submitting their research, scientific papers to ISAM-2022. The research work found to be very interesting, innovative and exemplary. The studies are comprehensive, focused to address clinical questions and were qualitatively in addition to the existing knowledge of Audiology.

I also thank all the coordinators and co-editing team of ISAM-2022, Ms. Subhasmita Sahoo, H.O.D. Dept of Audio Vestibular Medicine, Institute of Health Sciences (IHS), Ms. Sonal Daniel, Asst. Prof. Dept of SLP, IHS and Ms. Niharika Dash, Lecturer, Dept of SLP, IHS, Bhubaneswar, for their valuable contribution and help in compilation of the ISAM-2022 Journal.

I welcome all the researchers, practicing ASLPs, Scholars and Professionals to have happy reading. We request you all to continue your research works and contribute in future also.

We all, ISAM Team wish you all the very best in all your future endeavours.

The Readers are welcome to send your valuable suggestions and feedback to my mail: rajindrakumarp@gmail.com, and for swift information please call/whatsapp on +919849236299.

I thank all, Parents, Teachers, Lord OJG SK, Elders & all well-wishers for your kind blessings.

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Technical Section

Elizabeth Leigh
Audiologist, USA

Title: AUDITORY PROCESSING DISORDERS IN ADULTS: EVIDENCE-BASED IDENTIFICATION AND TREATMENT

ABSTRACT:

Auditory Processing Disorders (APDs) have been a challenge for audiologists for decades. Audiologists need evidence-based testing and treatment options specific to adults because their needs are different from children. Best clinical practice for APD in adults is based in functional assessment and functional rehabilitation, the specifics of each are presented.

The assessment, identification, and treatment of auditory processing disorders (APDs) began with a medical model based on site of lesion in adults which eventually led to a communication model based on developmental and educational abilities in children. Audiologists today, however, need a functional model based on whether, or not, their patient has an auditory component to their communication problems. Further, over the past several years, much of the clinical research has provided models of APD based on broader auditory-cognitive communication components that address functional abilities that form the basis of the work presented here.

For adults, the original basis for APD identification, i.e., site of lesion testing, was behavioral tasks designed to tap auditory cortical function to identify temporal lobe lesions prior to the use of imaging techniques widely available today. It is some of these very same tests we use today to identify functional deficits in central auditory processing. One of the most important differences between children and adults with regard to APD is the etiology of their hearing problems. In adults, most APDs are the result of head injury from motor vehicle accidents, falls, sports, etc. that are not identified by standard audiologic assessment (i.e., the audiogram and word recognition in quiet). Thus, the cause and treatment of these hearing problems must consider auditory processing deficits identified in the APD evaluation and rehabilitation process. A more current view of APD would be to look at the functional areas of difficulty for our patients and to facilitate an improvement in function.

This presentation is designed to look at the current status of APD in adults. It will cover the definition, symptomology, testing, and treatment of teens and adults with APD.

APD in adults is focused around identifying whether, or not, there is an auditory component to their hearing complaints. Auditory processing is assessed monaurally and binaurally, with speech and non-speech stimuli, and in noise and in quiet. Most adults presenting for APD evaluation experience persistent post concussive symptoms and particular attention is paid to how their receptive communication skills have changed following the injury.

Identification of APD, as recommended by both ASHA and AAA, is based on abnormal performance on at least two parts of the APD evaluation. In adults, the identification of APD is more challenging, due to a lack of standardized adult APD protocols, and must be based on a clear understanding of how an adult with a similar audiogram would perform on a particular set of tests. Research has shown there is no cookie-cutter set of tests that can be used with each patient and that an individualized assessment should be performed.

Adult APD services must be widely available in audiology clinics because there is no other profession with the expertise to evaluate and treat auditory processing problems. Failure to serve adults with APD results in reduced employment opportunities, increases communication failures with others (i.e., family members), and social isolation, especially as a result of a head injury. Treatment and recommendations are based on functional difficulties and tailored to support the educational, employment, and interpersonal communication needs of the individual.

Learning Objectives

After attending this presentation, attendees will be able to:

1. *Discuss the history of APD testing and how it applies to current testing and treatment*
2. *Identify test protocols and treatment methods for adults with suspected APD*
3. *Compare and contrast a variety of tests and treatment options for adults with APD*

Elaine Ng
Associate Professor , Cognitive Hearing Science
Linkoping University, Sweden

Title: BRAIN AND HEARING: DETECTING SELECTIVE SPEECH ATTENTION IN NOISE USING EEG

ABSTRACT:

In order to successfully communicate and navigate through complex listening environment throughout the day, it is essential to be able to focus and sustain auditory attention towards the talker of interest while ignoring irrelevant sound sources. In this talk, I will present a research study, using electroencephalography (EEG), aiming to objectively assess how attended and ignored speech is represented in the brain, and how well the enhancement of attended speech and suppression of ignored speech is achieved using advanced technology in hearing aids.

Neel Raithatha
Endoscopic Ear wax Removal Microsuction Specialist, UK

Title: CERUMEN MANAGEMENT

ABSTRACT

Earwax, or 'cerumen', is a natural substance secreted by the outer cartilaginous third of the external auditory meatus. It can be described as being either dry or wet in consistency and is made-up predominantly of dead skin cells that amalgamate with other organic compounds and sweat.

The presence of earwax is believed to provide several health benefits, such as the inhibition of certain bacterial and fungal growth that may lead to an outer ear infection, lubrication and moisturisation of the exposed epithelium skin layer of the ear canal, trapping of foreign bodies and particles, and the repelling of insects from entering the ear.

Earwax typicallymigrates out of the ear naturally in a conveyor belt motion and is non-troublesome. However, some people can experience earwax impaction, called 'cerumenosis'. Reasons for this can includeanatomical abnormalities of the ear canal, loss or slowing down of the natural migration process, hyperactive ceruminous and/or sebaceous glands, wearing of hearing aids and earbuds, and inappropriate use of cotton buds.

Symptoms of cerumenosis can vary from reduced hearing, otalgia, aural fullness, autophony and occlusion to tinnitus, vertigo, coughing and acoustic feedback of hearing aids. In extreme cases, it can also lead to psychological and emotional unrest and distress.

Cerumen management has evolved over the years. Ear wax drops are often used to soften and sometimes disperse ear wax. They can either be water or oil based but no conclusive clinical evidence supports the use of one over the other. Ear irrigation can be effective but has it's limitations and inherent risks. The gold standard method of cerumen management is microsuction and/or use of other dry ENT micro-instrumentation under direction visualisation. However, there many different visualisation techniques available to the Cerumenologist, such as otoscopic, microscopic and endoscopic, each possessing their own benefits and limitations.

Dr. Rajendra Kumar Porika
Advisory Member to TASLPA, Audiologist & Speech Language Pathologist, AYJNISHD (D) RC Secunderabad, Hyderabad

Title: TINNITUS HANDICAP INVENTORY AND ITS CLINICAL IMPLICATIONS

The perception of sound in the absence of external stimuli. “Tinnere” – means “ringing” in Latin. According to International Classification of Function, Disability & Health (2001): Tinnitus is described as a separate condition with sensation of low-pitched rushing, hissing, or ringing in the ears.

Tinnitus arises so many problems such as irritation, poor concentration, Stress, anxiety, depression, poor work performance, disturbances in sleep etc. Types: Subjective (common) & Objective(rare) Approximately 17% of the world population is troubled by tinnitus and it has severe manifestation in 20% of the cases. In India, it is estimated more than 47,928,177 (extrapolated data) may have tinnitus. Tinnitus has been found to affect more men than women (Lockwood et al., 2002). Men(12%) > women(7%). The prevalence of tinnitus increases with age (Ahmad & Seidman, 2004). It is most common between 40-70 years.

Importance of self reported Questionnaire :

Standardized & universally accepted grading tools are absolutely essential. There are no. of self-assessment tools have been designed by various authorities. A few commonly employed tools are mentioned here.

- Tinnitus Reaction Questionnaire (TRQ)
- Tinnitus Cognitions Questionnaire (TCQ)
- Tinnitus Functional Index (TFI)
- Visual Analogue Scale
- Tinnitus Reaction Questionnaire (TRQ)
- Tinnitus Cognitions Questionnaire (TCQ):

In 1991, Wilson and Henry et al. designed TRQ & TCQ, based on the cognition theory. Two questionnaires have 26 questions, Each of the questions asks about the responses of the individual patient, to tinnitus, in various real life situations. The TRQ items cover the (i) Emotional reactions, (ii)

Interference with work and sleep, and (iii) The feelings that are evoked due to tinnitus. The TCQ is based on the Cognition Theory. Out of the total of 26 questions, one half pertains to positive thoughts, negative thoughts which arise in mind, in response to tinnitus.

Tinnitus Functional Index (TFI) was developed by Miekle et al. 2012. It was found to be (i) highly sensitive to treatment effects i.e. 'responsiveness' (ii) addressing all major dimensions of tinnitus impact and (iii) validated for scaling the negative impact of tinnitus. It has got total 25 questions with eight sub-scales. The subscales like Intrusive, Sense of Control, Cognitive, Sleep, Auditory, Relaxation, Quality of life and emotional.

Tinnitus Handicap Inventory

- Developed by Newman, Jackbson & Spitzer 1996.
- THI is considered one of the most standardized, reliable and easy to administer questionnaires in the field of tinnitus.
- The THI Questionnaire comprises of **25 questions** with self-assessment on Likert's three point rating scale.
- **Yes(4) / Sometime(2) / No(0).**

Domain(s) covers…

- **Functional** reactions to tinnitus, such as difficulties to concentrate and anti-social trends.
- **Emotional** reactions to tinnitus, such as anger, frustration, irritability, depression.
- **Catastrophic** reactions to tinnitus, such as despair, a feeling of hopelessness, a fear of a "severe disease", loss of control and incapacity to cooperate.

Translations of THI

The THI has been widely validated and translatedinto many Language across the Globe in several Countries., For example, into Danish (Zachariae et al., 2000), Korean (Kim et al., 2002), Italian (Monzani et al., 2008), Chinese (Kam et al., 2009), German (Klenstauber et al., 2015), Persian (Jalali et al., 2015), and Russian (Oron et al., 2015). In India, THI has been translated into Telugu, Kannada, Malayalam Tamil and Hindi languages.

Translation & Development of THI in Telugu

First, the questionnaire was translated in to Telugu language with help of Linguist. The translated questionnaire was given to 20 bilingual professionals to know the adequacy of the content. The translated Telugu THI was served to 20 bilinguals for back translation into English. This validation process was carried in 120 subjects (60 with tinnitus & 60 without tinnitus).

Calculation of Severity of Tinnitus Handicap

THI Severity = Total No. of Yes (4) + Total No. of Some times (2)

Total THI Score = Severity of THI

Total THI score	Grade/Severity
0-16	No/Slight handicap
18-36	Mild handicap
38-56	Moderate handicap
58-76	Severe handicap
78-100	Catastrophic handicap

Dr. Pranesha Rao
Audiologist, Mahavir Jain Hospital, Bangalore.
Ex DRDO Scientist, Institute of Aerospace Medicine.

Title: VESTIBULAR FUNCTION ASSESSMENT AND NEWER DEVICES FOR VERTIGO REHABILITATION

VERTIGO MANAGAEMENT

Vertigo management has been an all along challenge to all medical professionals, more so far, an otolaryngologist. Many patients are not happy with anti-vertigo drugs like Mecilizine-vertin, Prohloroperazine – Stemetil or Cinnarizine – Stugeron. Some have resorted to vertigo exercises using collars and other medical treatment.

Experiments have been carried out using simulators like the Rotary Chair (Barany's), Torsion Swing, Roll simulator, Parallel swing etc.., estimating the objectively, the effect of electro-nystagmic responses and reduction in **average slow phases velocity** (aspv) on repeated rotations by keeping head position at various angles. These simulators were only restricted to Train pilots or Astronauts. It can now be used in clinical practice.

Vertigo is a symptom and not a disease. Some feel imbalances on walking and others feel head rotation (subjective sensation) or environment and objects moving around (objective feeling). Terrible attacks of giddiness include vomiting sensation (nausea), fullness of head, and ringing sound on either or both ears (tinnitus). Patient feels like lying down on bed for some time. These cause anxiousness and emotional problems (psychogenic). Some people experience giddiness when they move their head while getting up from the bed (positional vertigo).

There are more than 14 types of drugs, most sedative, cortical suppressants with secondary effects like drowsiness, fatigue, and nervousness. Due to modern stress induced by travel, Air and Sea sickness, the incidence of giddiness has increased. Age is not a factor to consider here.

An excellent indigenous attempt has been made in designing and fabrication of a Rotary Chair with high technology mechanism to operate for treatment and rehabilitation of vertigo cases. The newly designed chair rotates clockwise and anticlockwise at different speed, not exceeding 20 rpm.

This is an economically viable solution and a real boon to the vertigo patients. Many authorized in the field have expressed that habituation can be achieved, and the equipment can be an answer to that. Habituation leads to recovery from giddiness.

Proxysmal Vertigo	**Sudden** **Acute Attack** **Lasting few hours**
Single Severe Attack	Fading away slowly in days or weeks
Chronic Vertigo	Permanently present Lasting for months
Positional Vertigo	Fallowing sudden head movements
Dizziness fractions	Lasting a few seconds Occurring irregularly

The only methodology is to use this recently designed Rotary Chair for therapy.

INTRODUCTION

The world of tomorrow will be full of travelers. A large percentage of individuals suffer serious discomfort due to motion, travel sickness, sea sickness, air sickness, train sickness and car sickness will become a frequent complaint.

- Vertigo: Rotatory Feeling, hallucinations
- Dizziness: Disturbed sense of relationship
- Orientation: One's position in space.
- Vertigo and dizziness are only symptoms and not a disease.

Types of vertigo

Causes:

- Peripheral Causes
- Central Causes
- Intermediate Causes
- Degeneration (Old People)
- Drug Induced
- Unilateral Deficiency
- Vestibular Neuritis
- Vestibular Neuronitis
- Acute Vestibular Vertigo
- Unilateral Vestibular Paralysis
- Vestibular Peresis

- Neuro-labyrinthitis
- Epidemic Vertigo

Descriptions used by patients	
Dizziness	Light Headedness
Falling Sensation	Balancing Loss
Dizzy	Spinning
Woozy	Room Spinning
Giddiness	Vertigo

Associated Symptoms:

- Hyperventilation
- Headache (Fullness in head)
- Sweating
- Bradycardia
- Instability
- Photophobia
- Muscular Pain

Vestibular Equipment designed and developed by BNP Rao to assess the vestibular function on pilots

Barany Chair

REHABILITATION DEVICES

Parallel Swing (linear acceleration)

This was used for simulation Otolyth organ. It is a platform fixed by four corners and swings in a horizontal plane in one direction. The greatest amplitude of the swing is 125cm and acceleration of 348cm/s2. The oscillations were kept at 3-4 seconds. I provoke sinusoidal, alternating linear acceleration. This results in vestibular eye movements. The person may even feel severe nausea. We can even monitor rotary nystagmus, pulse rate, BP, and record ECG. On movement the person feels the sensation of going up and down when eyes are closed.

Gymble Mounted tumbling device

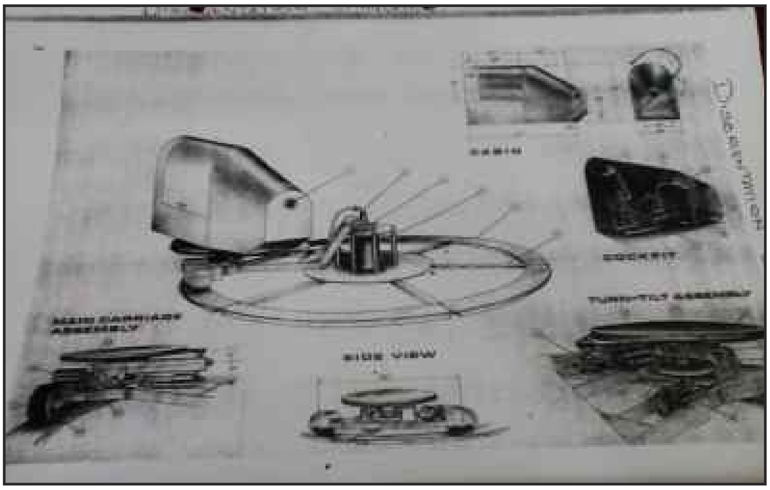
This is an indeginous development in which the subject manuvers on his own with roll to the left and right 90 degrees, 180 degrees and tumble also. This simulates all semicircular canals. This is a good device noted by NASA.

Torsion Chair

Both horizontal canals are simulated simultaneously. It provokes alternating angular acceleration in a horizontal plane. This test is also both qualitative and quantitative. This was used as an alternative for caloric test. This chair has to be individually fabricated. The patient sits on the chair. Swing can be given at 90 degrees or 180 degrees and made to oscillate. This swing is useful for calculating Nystagmus as well. This habituates semicircular canals by changing the head positions with proper chin rest. Daily practice will bring and reduce the severity of giddiness.

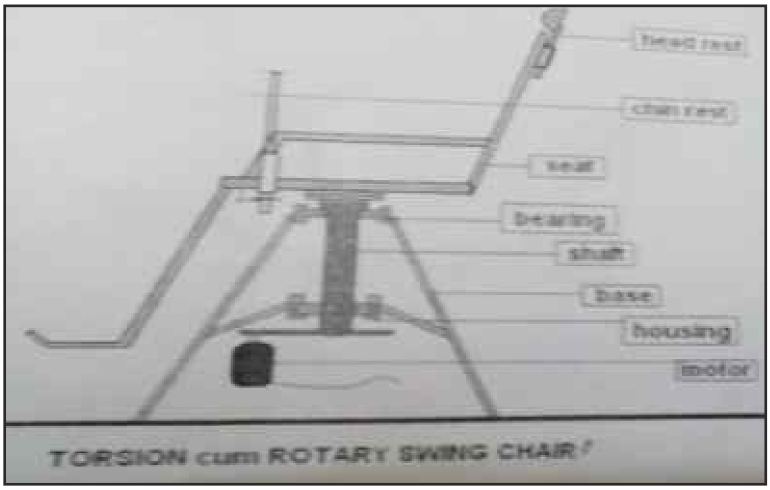
Disorientation Simulator

This is the most useful for rehabilitation. The subject is seated in a dark cabin and is asked to gaze at a light point in front of him and to narrate how he feels. The simulator moves on a circular rail with elliptical movements with a tilt at the same time causing a virtual feeling in the space. By these all three semicircular channels are simulated simultaneously including perilymph and endolymph.



Rotary chair

After considering the various aspects involves in the complications of various devices, I have invented this chair which can be rotated clockwise and anticlockwise with a swing as well. This can be experimentally proved to be effective after repeated rotations. The details are mentioned at the end. As a scientific paper presented at the SAARC conference at Delhi.



Vertigo (Giddiness) Therapy:

12 – 15 days therapy
30 minutes each day
All Vertigo related to Vestibular system can be rehabilited

Benefits of Vertigo (Giddiness) Chair:

Vertigo chair is made beneficial for treating vertigo (giddiness) and imbalance without any drugs

Noninvasive treatment

Vertigo chair can be used for habituation for clinical trials as a diagnostic tool

Vertigo chair can be used for treating people being afraid of heights

Sea sickness and Travel sickness patients can also be treated

More effective than medication as it treats the source problem

Scientific Section

LISTENING AND COGNITIVE EFFORT IN ELDERLY POPULATION

Author Details- *Abhishek B.P (Ph D), Associate Professor and Research Coordinator, Nitte Institute of Speech and Hearing, Mangalore.*

Abstract

Presbycusis refers to age related hearing loss. Elderly population exhibit problems related to listening, they also show problems on behavioral and cognitive domains. Listening effort and fatigue are commonly seen in persons with presbycusis. The listening effort and fatigue is assessed through experimental tasks or through self-assessment measures. Self-Assessment measures are time conservative measures and can enable researchers in understanding the problem from the patient's perspective. 40 participants were enrolled for the study. The first group comprised of 22 individuals who reported hearing loss while the second group consisted of 18 individuals who did not report hearing loss. A questionnaire tapping listening and cognitive effort was administered on the participants. It was found that participants from both the groups exhibited listening effort.

Key words - *Fatigue, Cognitive Effort, Listening Effort*

INTRODUCTION

Hearing impairment is assumed to affect the overall well-being of the individual. Elderly patients with hearing loss experience plenty of problems affecting their quality of life. Thus, there is need to identify hearing loss in this population and the minimize the barriers affecting the well-being.

There are cognitive and behavioral changes associated with aging. The change in aging is classified under normal aging and pathological aging. If the cognitive aging corresponds to the persons biological age it is called normal aging, pathological aging on the other hand is when the cognitive aging does not match with the persons biological age. Hearing loss is one of the main consequences of aging. Hearing loss associated with aging is called Presbycusis. If presbycusis is not managed properly, it may further lead to cognitive, behavioral and social problems.

As far as listening effort is concerned, elderly patients with presbycusis experience problems in localisation. They find it difficult to understand speech especially in noisy environments. The cognitive domains may get affected as a consequence of aging. It can even alter the speed of processing. Elderly patients with presbycusis allot additional cognitive sources to listen properly leading to fatigue. This additional effort invested to listen to is called as cognitive or mental effort. A proper amplification device may minimize the cognitive effort.

The listening effort is tested by simulating difficult to test situations. A study was carried out by Pichora-Fuller, Schneider, and Daneman (1995). This study examined the contribution of working memory on speech understanding in noise for 16 younger (19-23) and 16 older (64-77) participants with normal hearing. The participants were presented with sentences and they were asked to recall the final word of the sentence. Younger participants as well as older participants found it difficult to recall words. However, the identification scores were poorer in older individuals compared to young individuals showing that the listening effort was more in this population.

A study on the similar lines was carried out by Murphy, Craik, Li and Schneider (2000). This study examined the effects of aging on working memory performance. The participant groups were similar to the previous study where younger participants with normal hearing and older participants with high frequency hearing loss were enrolled for the study. Paired associate recall was administered on the participants. The stimulus was presented in (a) Noise and (b) no noise situations. In the no noise situation, performance of younger adults and older adults was equivalent. In noisy situations there was a difference and the authors concluded that working memory was affected in this population indicating that this population is vulnerable to develop cognitive problems.

Listening effort and fatigue can be differentiated. If the person invests more listening effort over a prolonged period of time, it can result in fatigue (Mc Doud& Shaw, 2000). Measurement of listening effort and fatigue is important in research perspective as well as clinical perspective. The listening effort is less explored in clinical scenario. Since hearing loss can affect the well-being of the individual it would of prime importance to assess listening effort. The listening effort can be assessed by simulating difficult to listen situation or employ self-report, behavioural, and physiological measures. The self -reporting may have advantages as well as disadvantages. The advantage is that it is a time conservative measure as it may not consume much time. The disadvantage is that it is subjected to bias and it would be precisely rated by few participants and it would important to correlate these measures with objective measures. Never the less the questionnaire reflects the problem from the patient's perspective.

Need for the study: There are some overt and covert circumstances associated with hearing loss. Listening and cognitive effort are two such measures which can be a covert circumstance. Many a times in the clinical scenario, the listening or cognitive effort induced by hearing loss may not be tested and the problem would go unidentified. If the problem goes unidentified it can result in social, behavioural and cognitive changes. Hearing loss can have devastating circumstances specially in aging population. Thus, it becomes important to assess the cognitive and mental effort associated with hearing loss in elderly patients.

Aim: The present study was carried out with the aim of measuring the listening and cognitive effort in participants in the age range of 50-70 years.

METHODOLOGY:

Stimulus: The Listening Effort Assessment Scale (Alhanbali 2017) was administered on the participants. It is a self-rating scale which would require the participants to rate the listening and cognitive effort which they confront in day-to-day situations. The questionnaire comprises of 10 questions tapping different domains related to listening and cognition like the amount of effort required while indulging in a conversation in the presence and absence of noise. The amount of concentration required for handling these conversations. There was one question which was specific to telephonic conversation. Though the questionnaire comprised of 6 question, one question on the amount of listening effort required while listening to lectures was modified to the amount of listening effort required while watching TV as this question was culturally apt in Indian contexts

Adaptation: 6 questions were developed in the lines with the reference questionnaire. The questions were rephrased and translated to Kannada; a regional language used in south India. The questions were given in bilingual format where the questions were in English as well as Kannada. The questionnaire was circulated to 3 judges who were asked to judge the aptness of questions. All the judges were bilinguals and were able to judge the forward and backward translation also. Once the questions were deemed appropriate by the judges. The questionnaire was circulated to the participants.

Analysis: The participant was supposed to mark his response on a visual analogue scale having options from 1-10. 1 referred to Lots of Effort while 10 referred to No effort.

Participants: The questionnaire was administered on 40 participants in the age range of 50-70 years and the participants were divided into two groups. The first group comprised of 22 participants who had reported to the Out-patient department of a hospital while the second group comprised of 18 participants in the same range with no compliant of hearing loss.

Scoring: Descriptive analysis was carried out to analyze the problems confronted by individuals with hearing loss

RESULTS AND DISCUSSION:

The mean score for first group was 3.5 (SD 1.28) while the mean score for the second group was 5 (1.46)

Table 1: Question wise scores for group 1 and group 2

Sl No		Group 1	Group 2
1	Do you have to put in a lot of effort to hear what is being said in conversation with others?	3	6
2	How much do you have to concentrate when listening to someone?	4	4
3	How easily can you ignore other sounds when trying to listen to something?	3	6
4	Do you have to put in a lot of effort understand speech in multi-speaker environment	3	5
5	Do you have to put in a lot of effort to listen on the telephone?	4	5
6	Do you have difficulty in understanding TV programs	3	4

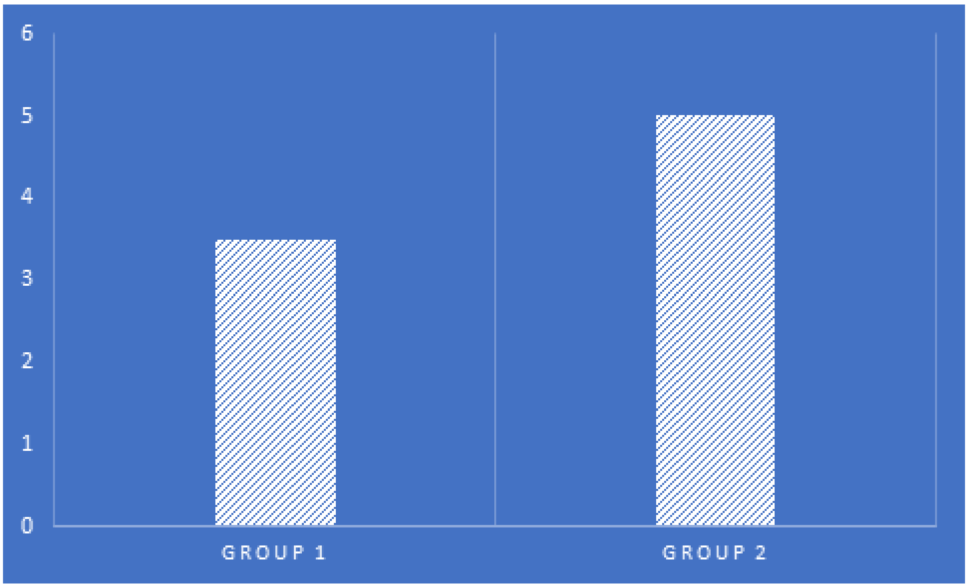


Figure 1: *Comparison of performance of Group 1 and Group 2*

Data was subject to the test of normality by using Shapiro-Wilk's test and the Z score was < than 0.05 indicating the data was non-parametric. Further Mann Whitney U test was carried and the results showed no significant difference between the two groups. The results highlighted the elderly patients who reported hearing loss and who did not report hearing loss experienced a greater listening and cognitive effort in the day-to-day conversation. Thus, there is a need to sensitize this population on hearing evaluation and conduct an audiological evaluation as this population is vulnerable for hearing loss. Those who had reporting loss should be suggested with proper amplification device to reduce the listening and cognitive effort experienced in routine.

Listening effort was seen in elderly patients regardless of whether the individuals reported hearing loss or not. The elderly participants reported problem on all domains. The difficulty was not situation specific. This showed that elderly patients experience listening effort and fatigue.

CONCLUSION:

The study was carried out with the aim of investigating the listening effort in elderly patients. 22 participants who reported hearing loss and 18 participants who did not complain hearing loss participated in the study. All the participants exhibited listening effort. The results highlight the importance of providing a suitable amplification device for the elderly to minimize the listening effort.

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Questions

Do you have to put in a lot of effort to hear what is being said in conversation with others?

How much do you have to concentrate when listening to someone?

How easily can you ignore other sounds when trying to listen to something? Not easily ignore

Do you have to put in a lot of effort understand speech in multi-speaker environment

Do you have to put in a lot of effort to listen on the telephone?

Do you have difficulty in understanding TV programs

Response scale

No effort 0 1 2 3 4 5 6 7 8 9 10 0 1 2 3 4 5 6 7 8 9 10 Lots of effort

AUDITORY AND VISUAL RECALL ABILITIES IN INDIVIDUALS WITH MCI

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Abstract

Recall is an event associated with our routine where we try to recall names or events. The recall can be converted to an experimental task to assess memory where the stimuli would be presented first and the participant can be asked to recall the items presented. This can be done immediately after the stimulus presentation or after a lapse of time. The former is called immediate recall while the latter is called delayed recall. If the participant is asked to recall the items in a stimulus set in any order they want, it is called as free recall. The current study was carried with the aim of assessing free recall on immediate basis in participants with Mild Cognitive Impairment. The stimulus was presented in auditory and visual modalities. The participants were asked to recall the items presented visually and auditorily in any order they want. The results showed that the performance was better for auditory modality than visual modality suggesting that there was more capacity limitation for visual than the auditory modality.

Key words: *Free recall, immediate, modality, domain*

INTRODUCTION

Aging is a normal phenomenon. Advanced aging is often associated with changes in brain morphology and structure. Several examinations of brain tissue have revealed a varied array of age-related changes in the brain. Theories of ageing explains decline in the performance across age in a variety of tasks, either with respect to a deficit in the core cognitive function, or according to deficits in set of cognitive functions like processing speed, executive functioning (Salthouse, 1996), inhibition, capacity of working memory (Chavo& Knight, 1997).

Aging is assumed to be a consequence of natural maturational processes. Cognitive aging is complex and it is the age-related decline in the mental functions such as memory, executive functioning, processing speed, and reasoning and multi-tasking which are critical for everyday functioning. It is assumed that there is a dynamic relationship between brain and cognition and this may change across the lifespan.

Pathological aging, on the other hand is assumed to be a consequence of altered brain maturational processes. Cognitive impairment can be described as any characteristic that acts as a barrier to cognitive process (Struss, 1992). Understanding cognitive change due to aging will help to realize that these changes in cognition are not noticed the same across all cognitive domains. The basic cognitive functions most affected by age are attention and memory. Older individuals exhibit substantial deficits in tasks that involve actively manipulating, reorganizing or integrating the contents of working memory. The ability to inhibit irrelevant information and the speed of information processing is impaired leading to the ineffective performance of these higher cognitive tasks. Cerebral atrophy, ventricular enlargement, and hippocampal atrophy are more rapid in progression and very much evident in the pathological aging process Individuals with pathological aging may confront more severe and deep-rooted impairment in cognition especially in the aspects of memory and executive functioning, than compared to individuals with normal aging which would act as a barrier for carrying out everyday activities, living independently, and for general health and well-being (Elias, 1995).

Mild Cognitive Impairment refers to a condition where the quantum of cognitive impairment is greater than their neuro typical peers but lesser than Dementia. It is considered as an intermediate stage between typical aging and Dementia. Persons with Mild Cognitive impairment exhibit deficits related to different cognitive domains like memory, attention, reasoning etc. Mild Cognitive Impairment cannot cause a serious impact on the activities of daily living but never the less can affect the overall well-being of the individual.

The cognitive decline is greater than expected for an individual's age and education level but that does not interfere notably with activities of daily life(Petersen, Smith, Waring, Ivnik, Tangalos, &Kokmen, 1999). The condition usually affects only in one domain (e.g. Memory) and who do not meet the clinical criteria for dementia. It causes a slight deficit but a decline in cognitive abilities can be noticed and measured. In the recent years, the mild end of the cognitive spectrum is given substantial attention. MCI spans from normal aging to Alzheimer's disease and can be called as a transitional period between normal aging and clinically probable very early AD and several research studies have reported that the individuals with MCI are at increased risk of developing dementia in their later days (Petersen, et.al., 2001)

The cognitive changes from normal aging through mild cognitive impairment ultimately leading to dementia is worthwhile to depict as a continuum. But as a manifestation of aging, everyone will not experience this transition. Hence, certain aspects of learning and recall performance, the status of apolipoprotein E, and neuroimaging features of hippocampal regions should also be considered as salient predictors of deterioration. Many research studies have reported MCI as an intermediate stage in a cognitive continuum and thought to be as a phase between the changes that occur due to normal aging and very early dementia (Peterson, 2001et al). ThusIt is assumed that there would be a continuum between normal aging and pathological aging.

Persons with Mild Cognitive Impairment exhibit deficits in one or multiple linguistic domains. Memory is one the major domains affected in this population. Recall task can be used to tap the memory domain. Memory functions like recall are seen to have the highest predictive power for indicating early AD. In most of the neuropsychological measures, delayed recall of a word list was the most successful task to discriminate and classify appropriately 96% of normal subjects and 86% of mild AD subjects. Lesions in the frontal lobe were also seen to significantly affect recall abilities as they recall only fewer words in total and they exhibit lower serial recall scores and make more intrusions and intra-list repetitions from previously studied lists (Hildebrandt, Brand & Sachsenheimer, 1998). Recall in neurological disorders are not explored in this particular study, but has been mentioned here as there is greater significance of recall tests in identifying memory disturbances in the initial stages of the disease compared to other tests or functions of memory.

The current study was an attempt in investigating the auditory and visual recall abilities in MCI Individuals to verify if there was any domain specific deficit in this population

Need for the study: Identifying the domain which is spared and the domain which is affected would helpful in providing therapy as the therapy may focus on working on the affected domain. It would also help communication facilitation in the spared domain.

AIM: To investigate visual and auditory recall abilities in individuals with MCI

METHODOLOGY:

The study was carried out with the aim of assessing recall abilities in Individuals with Mild Cognitive Impairment. The recall task is assumed to assess all the stages of memory starting from storage, encoding and retrieval. The visual and auditory recall abilities were compared in the current study. The purpose of comparing auditory and visual recall is of importance for two prime reasons. The first reason could be that the deficits in Mild Cognitive Impairment could be domain specific. Second reason is that if the domain specific impairment is identified effectively, retraining could be given in that domain or the spared domain can be given importance in training (futuristic strategy)

10 participants with the complaint of cognitive problems over a period of 6 months and above were enrolled for the study The mean age of the participants was 62.3 years. Convenient Sampling was used for recruitment of participants. Montreal Cognitive Assessment (MOCA) was administered on the participants. The scores on MOCA ranged from 17 to 24 confirming the diagnosis of MCI. The diagnosis was confirmed by Neurologist also. Most of the neurological reports suggested atrophy.

All the participants were graduates and had considerably good reading and writing problems even after the onset of the problem. Visual Recall task was administered on the participants. The stimulus comprised of short words in Kannada (a language spoken in South India) **Stimulus** The lists were recorded on CSL 4500, one word being presented every 1 sec and was presented through headphones. The last item of the list was indicated by changing the inflection, similar to that at the end of a spoken declarative sentence. The stimulus was randomized during the presentation.

Each stimulus set had 6 words The participants were asked to recall the items in the specific stimulus set in any order they want as the task undertaken was an auditory recall task. Each correct response was given a score of 1. Thus, each stimulus set carried a score of 6. There were 5 such stimulus sets. The maximum score accounted to 30. The only difference between auditory and visual recall task was that modality of presentation. The stimuli in visual recall as well as auditory recall task was presented in a successive order. In the same lines, auditory recall task was administered on the participants. The two-recall tasks were administered on separate days to counteract practice effect.

RESULTS AND DISCUSSION:

As stated in the previous section, the study was carried out with the aim of assessing auditory and visual recall. The stimulus was presented first in visual modality and the same stimulus was presented in auditory modality after a lapse of 1-2 days to prevent practice effort. The practice effect is also found to be a minimal in a population like MCI where there isa prime memory deficit. The order of presentation was also different

For recall, the stimuli were presented in stimulus set. Each stimulus set had 6 stimulus and totally there were 5 such stimulus set. Thus, the total score accounted to 30. Free recall task was administered on the participants where the participants were given the flexibility of recalling the items in any order they want. The mean scores for auditory was 16 for the MCI individuals while the scores on visual recall was 12.

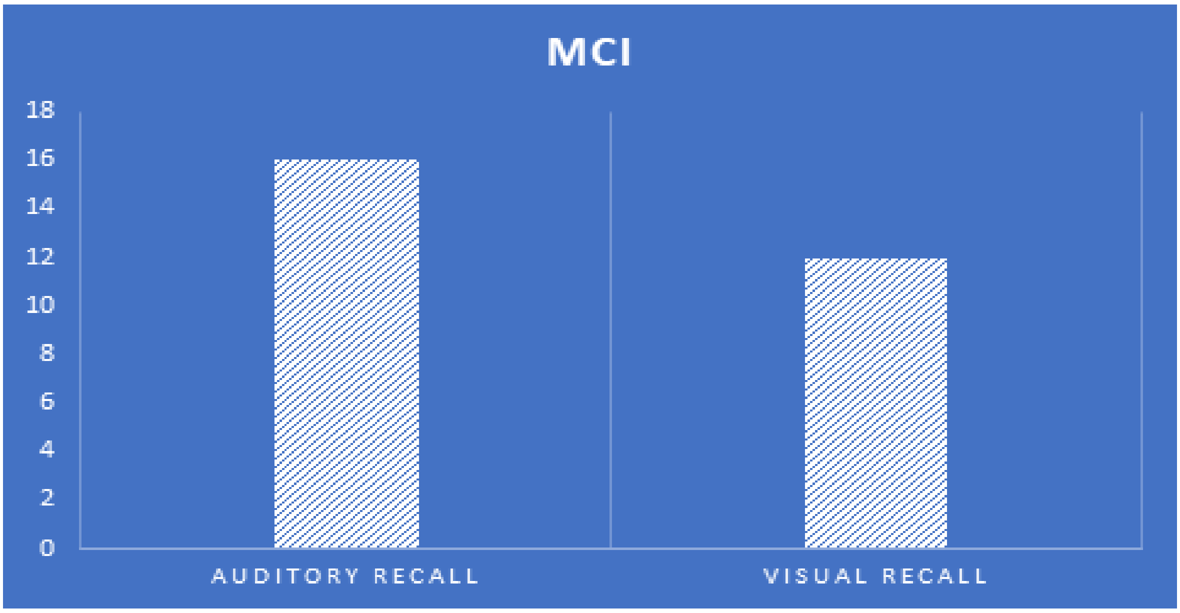

Figure 1: *Auditory Recall versus Visual Recall in MCI*

In order to verify if there was any significant difference between visual and auditory recall abilities, Wilcoxon's signed rank test was administered (as the data was non-parametric, as proven on Shapiro Wilk's test of normality and the Z score was 2.68 ($p<0.05$) showing that there was significant difference between the two domains of recall. The results showed that auditory recall was better than visual recall in individuals with MCI. The results showed that there was a domain specific deficit in the participants.

Recall task would basically assess for the three stages of memory i.e. storage, encoding and retrieval. The person has to store the item, encode the stimulus and then should be able to produce it. The recall task was immediate in the current study and the recall task was a free recall task, where the participants were given the flexibility to recall the items in any order they want. The overall performance of participants with MCI was poor. They were able to recall only few items in each stimulus sets. The performance was better on auditory recall than visual recall task. This showed that storage was better for stimulus presented in auditory modality. The result showed that there was a domain specific deficit in individuals with MCI with the visual domain showing more deficit compared to the auditory domain. The results also show that the there was more capacity limitation in the visual modality compared to the auditory modality.

CONCLUSIONS:

The study was carried out with the aim of assessing visual and auditory recall abilities in Individuals with MCI. The stimulus was presented in auditory and visual modalities. The participants were asked to recall the items in any order they want. The recall task was immediate. The results showed that visual recall was affected to a greater extent than auditory recall.

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EFFECTS OF ACCEPTABLE NOISE LEVEL, TEMPORAL RESOLUTION ON AIDED SPEECH PERCEPTION ABILITIES IN MIDDLE AGED AND OLDER ADULTS WITH HEARING LOSS

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Keywords: *SPIN, Acceptable noise level, older adults, SNR-50*

INTRODUCTION:

Temporal resolution is the ability of the person to identify a small change in the acoustic signal which is very crucial for understanding speech stimuli [1]. Temporal resolution ability allows us to detect small and sudden change in sound stimuli. Good auditory temporal resolution ability is important for understanding speech in noise in listeners in normal hearing and hearing aid users.[2] With varying background noise in daily life it becomes difficult to understand speech in such circumstances. Person with hearing loss faces a lot of challenges in these situations as the acoustic signal gets diminished due to hearing loss. The ability of the person to ignore the background noise and concentrate on the speech signal is almost impossible, but if the persons' noise acceptance levels are good then in turn the speech identification issues are reduced to a minor extent. The acceptable noise level (ANL) determines the maximum noise level that an individual is willing to accept while listening to speech.[3] ANL can be used to assess the hearing aid benefit, and also to predict the hearing aid use.[4]

Hearing aids are a common type of management used for individuals with hearing loss. But few limitations with the hearing aids are the speech perception abilities in presence of background noises. Hence measures such as one's temporal resolution skills, ANLs can help to predict the hearing aid performance and also can aid in estimating the benefit from hearing aids. Although both the skills are different in their own way, the hearing aid performance in presence of noise can be related to ANL and temporal resolution abilities. Studies on ANLs across gender[5] and different age groups[4] have found no significant difference. As the perception of speech in background noise depends on the temporal processing abilities, we assumed that the ANL and temporal resolution can vary across age and can influence the aided performance. Study on temporal processing across age has shown that the temporal processing abilities start deteriorating after the fourth decade of life [6]. Hence the present study will focus on identifying the measures that can influence aided speech perception in noise across two age groups.

Aim:

To investigate the effects of acceptable noise level, temporal resolution on aided speech perception abilities in middle aged and older adults with hearing loss.

Objectives:

To study the effects of ANLs and temporal resolution on aided speech perception abilities in middle aged adults with sensorineural hearing loss.

To study the effects of ANLs and temporal resolution on aided speech perception abilities in older adults with sensorineural hearing loss.

METHODOLOGY:

***Participants*:** A total of 37 individuals were included in the present study consisting of 22 older adults in the age range of 60-79 years (mean age of 71.4 years)and 15 middle aged adults with age range of 35 years to 50 years (mean age of 43.2 years). All the participants were included for the study using convenient sampling methods who were identified with moderate to moderately severe sensorineural hearing loss. All the participants were hearing aid users, using hearing aid for 2-3 months. The hearing aid fitting formula and the features in the hearing aids were similar in all the participants.

***Procedure*:** Each individual is asked to use an up-and-down approach to adjust the sound level of the story passage to the most comfortable level (MCL). The stimulus was presented through calibrated loudspeakers placed at 45 degree azimuth. The stimulus was presented at 40 dBHL and varied in 5 dB steps to meet the MCL. Followed by MCL, background noise was added and adjusted to a level where the individual prefers that minimum level where the story is audible comfortably even with the presence of background noise. This level is known as Background Noise Level (BNL). The speech noise was used as stimulus to obtain BNL. The ANL was calculated as the difference between MCL and the BNL.

For temporal resolution abilities the gap detection in white noise was used. Gap detection threshold (GDT)was administered using 3 alternative forced choice methods (AFC) presented through a laptop (Dell Inspiron 15, model 3521) using a recent version of MATLAB software. The MLP toolbox was used for measuring GDT. A 750 ms Gaussian noise was used as the stimuli. The noise with a gap in its temporal centre served as the variable stimulus, and broadband noise of the same duration with no gap/ continuous served as the standard stimulus. For the variable stimulus, the noise had 0.5 ms cosine ramps at the beginning and at the end of the gap to avoid spectral cues. The gap duration was varied according to the listener's performance. The task for the participants was to identify the gap in the stimulus among the three stimuli. The subjects were instructed that "you will be hearing three noise stimuli wherein two will be continuous while one will have a gap or a period of silence. Your task is to identify which among the three is having the gap even if it is just detectable. The starting level of the gap was 64 ms with the first midpoint at 0.1 ms and last midpoint at 64 ms. The gap detection threshold for all the participants was noted.

The aided speech perception in noise was assessed using standardised lists of PB sentences in Kannada for adults developed by Geetha, Kumar, Manjula, and Pavan (2014) were used as stimuli for the administering speech recognition abilities in presence of noise in order to measure SNR-50. Each sentence in the list was mixed with speech noise to obtain different signal to noise ratios (SNRs), i.e., +10, +8, +6, +4, +2, 0, -2, -4 and -6 dB as SNR. The presentation level was kept constant at 40 dBHL. The stimulus was presented through calibrated loudspeakers kept at 45 degree azimuth. The subject was instructed to repeat the sentence as accurately as possible. The number of keywords correctly repeated was noted. The SNR-50 was calculated using the Spearman Karber equation.[7]

SNR-50 = I + 1/2 (d) (#correct)/ (w)

Where, I – initial presentation level = +8 dB

d- Attenuation step size = 2 dB

w –number of keywords /decrements =5

c- Total number of correct key words (out of 35)

The scores obtained were tabulated. The statistics used in the present study were: descriptive statistics to calculate the mean and standard deviation of the data followed by inferential statistics which included Shapiro Wilk test of normality, Spearman rank correlation, and linear regression.

RESULTS AND DISCUSSION:

The present study focused on exploring the effects of acceptable noise levels and temporal resolution on aided speech perception abilities in middle aged and older adults with hearing loss. The obtained data were subjected to descriptive and inferential statistics using Statistical Package for the Social Sciences (SPSS) version 21. The mean ANL, GDT scores, and aided SNR-50 scores are represented in Figure 1, 2, and 3 respectively. It can be seen from figures 1, 2, and 3 that the scores of older adults are higher when compared to middle aged adults.

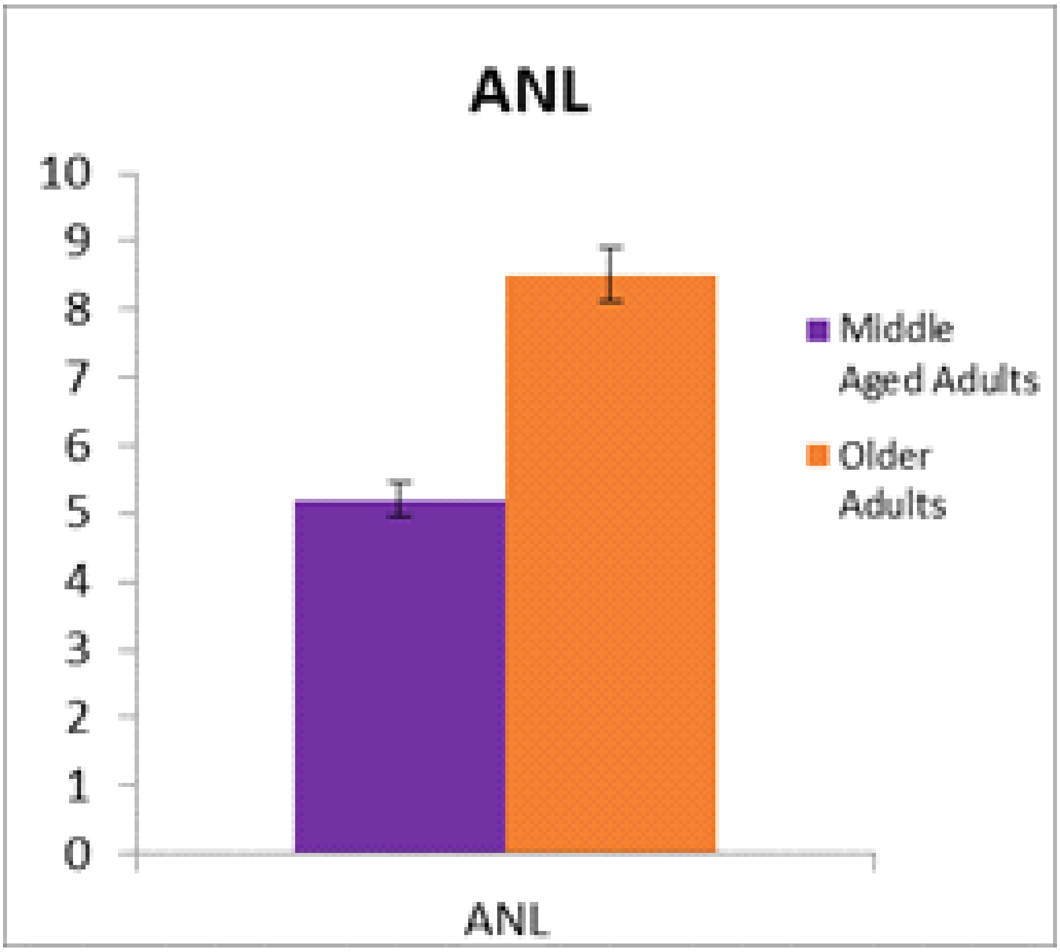

Figure 1: *ANL scores obtained for middle aged and older adults. Error bars show ± 1 SD.*

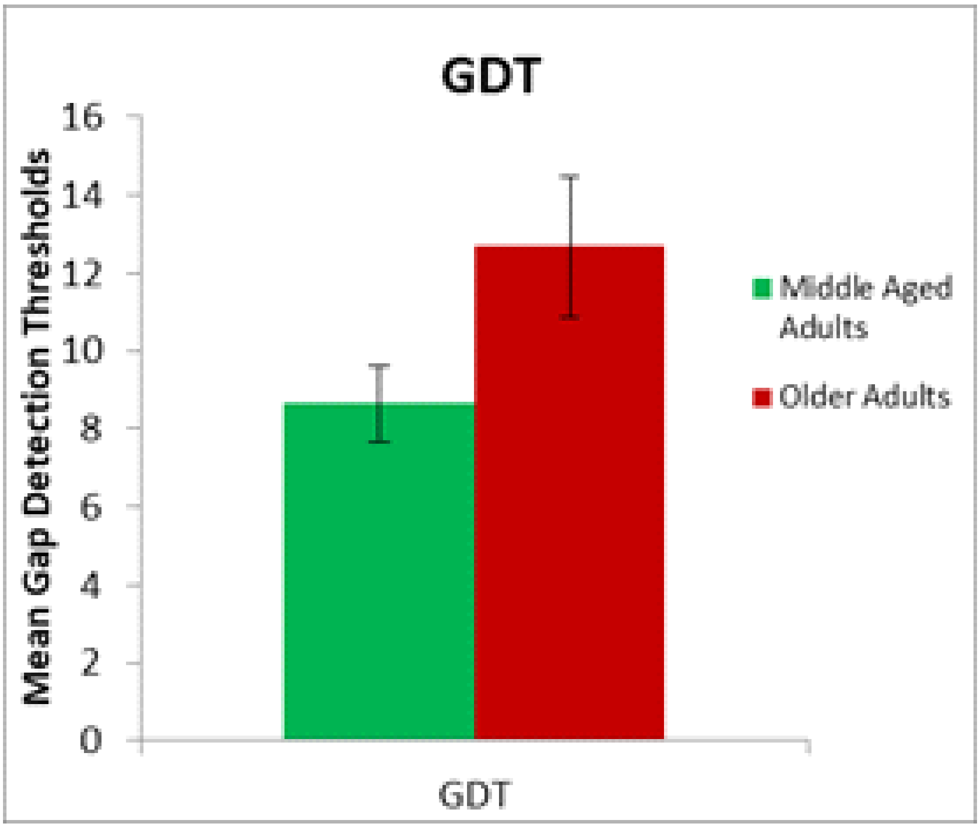

Figure 2: *GDT scores obtained for middle aged and older adults. Error bars show ± 1 SD.*

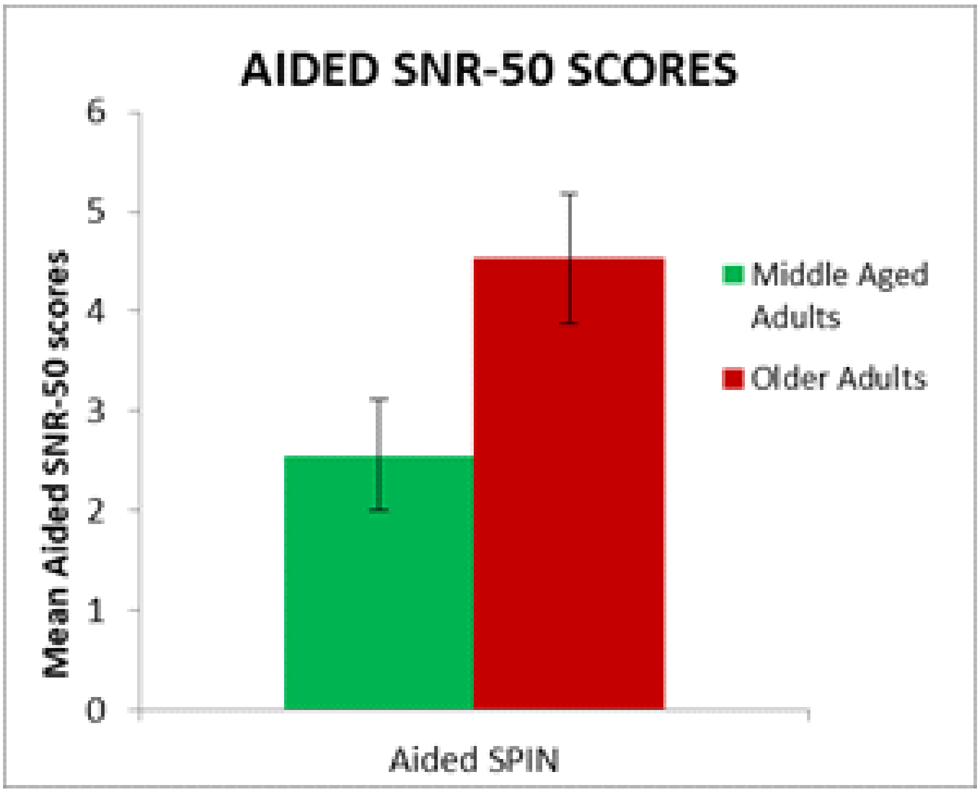

Figure 3: *Aided SNR-50 scores obtained for middle aged and older adults. Error bars show ± 1 SD.*

The data were further subjected to the Shapiro-Wilk test of normality to analyse the normal distribution of data in both the age groups. The results showed that the data was not normally distributed ($p<0.05$). In order to study the objectives of the study, ANL and GDT scores were subjected for Spearman rank correlation with aided SNR-50 scores. Results revealed that ANL(r_s= -0.78, $p<0.001$) and GDT(r_s= -0.69, $p<0.001$) had strong positive correlation with aided SNR-50 scores in both younger and older adults with sensorineural hearing loss. This suggests that both ANL and GDT have an influence on aided SNR-50 scores. Lower the ANL lower is the SNR-50, similarly lower the GDT lower is the SNR-50 scores. This is in line with the findings of Nabelek et al who provided an emphasis on the value of the ANLfor successful use of hearing aids[4]. Linear regression analysis was done and results revealed that ANL can be used as a predictor of aided SNR-50 scores.

The results show that older adults require higher SNR values when compared to middle aged adults and also shown a higher GDT scores compared to middle aged adults. These results can be attributed to decrement in temporal processing in older adults[6]. The affected temporal processing in turn can affect one's speech perception abilities causing SNR -50 scores to be higher. Also the changes in cochlear processing abilities due to aging auditory system could have influenced for higher SNR-50 scores and in turn having higher ANL scores in older adults[8]. The temporal fine structure which is crucial for hearing in background noise might also be one of the reasons[9]. The changes in anatomical structures of cochlea over age and its processing for perceiving rapid amplitude fluctuations becomes major concern in coding temporal fine structure. This may also be one of the reason of poor performance in older adults.

SUMMARY AND CONCLUSIONS:

The present study investigated the effect of ANL and temporal resolution on aided SNR-50 in middle aged and older adults with hearing loss. The results show that ANL and GDT have a good correlation with SNR-50 which infers that both tests are dependent. The data helps audiologists to counsel the individuals while testing for speech in noise tests and also for testing hearing aid performance.

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SENSORY MODALITIES AND OTHER FACTORS AFFECTING SCORING OF AUDITORY WORKING MEMORY TEST

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Key word: *Digit span test, Hearing loss, Auditory working memory, presbycusis*

INTRODUCTION:

Working memory (WM) is the process of keeping information for a short period of time. WM refers to a brain system that provides temporary storage for complex cognitive task. The working memory capacity is limited and it performs both the functions of memory and processing for a short duration of time (Baddeley, 2012). It has application in all human activities including speech perception (Baddeley, 2003). Although various mechanism of the complex interaction of cognition have been hypothesized (c.f. Nixon et.al., 2019; Pichora-Fuller & Singh, 2006), these complex interaction of cognition and speech understanding has been very lucidly described in the Ease of Language Understanding model (ELU; Rönnberg, 2003; Rönnberg et.al., 2010, 2013, 2016, 2019). This model hypothesizes that either language understanding or speech recognition is effortless when the incoming stimuli matches with the stored representation of language in the memory system of an individual. However, in adverse listening conditions, such as in presence of background noise, reverberation, hearing loss, or co-existence of more than one difficult to-listen condition, cognitive resources are employed for speech understanding. In particular, the ELU model predicts that in unfavorable listening conditions, speech recognition essentially requires involvement of working memory and its central component, executive functions (Rönnberg et. al., 2016, 2018). WM serves as an interface between perception, long term memory and action. Despite physical absence of sensory input, a representation of the information can be maintained over a period of time (Baddely,2012).

There are a lot of tests available to determine working memory capacity. Digit span test is one of the easily accessible tests to detect WM.

Digit span test

Wechsler,s Digit span test consist of two subtests. One is digit forward test and another is digit backword test. In this test the examiner asked the participant to repeat increasing span of digit in forward manner for digit span forward test and in reverse manner for backward test. The length of digit increases in each line. For each trial in forward and backward digit span test , a correct response will score as 1 and incorrect score will be marked as 0 .The item score is the sum of the score in two trials . The maximum score in each sub test will be 16.

Need of the study:

For cognitive healthy adults with hearing loss, audiologists are less concerned with their listening processing as they already have intact language and cognitive skills. Thus, audiologists generally provide adequate and appropriate hearing technologies to make sound more accessible for these individuals. Several studies suggests that WM plays a key role in understanding speech (Pichora-Fuller et al., 1995; Wingfield and Stine-Morrow, 2000; Akeroyd, 2008) and also to predict performance on tasks including phonological processing (Classon, Rudner, &Ronnberg), and attention (Kane & Engle, 2003).Digit span test is mostly used to assess working memory capacity of patient. There are so many factors which affect the scoring of digit span test. For a proper evaluation of test we need to know about the factors which are affecting the results.

AIM OF THE STUDY:

The main aim is to evaluate the possible factors affecting the result of digit span test.

OBJECTIVE:

To conduct digit span test in auditory and visual modalities and to compare the scoring of these modalities.We carry out this test in presbicusis patients to find out the relations between working memory and hearing loss.

METHODOLOGY:

We recruited 50 participants having age range (18-32), mean (21.42) and standard deviation 2.49having normal hearing sensitivity in group 1. We also included 21 participants of age range (50-74; mean: 62.29; SD: 4.9) having age related hearing loss. All the subjects have no previous history of any psychological or cognitive problem.

Procedure

A written consent for participation in the test was obtained from the subjects after they were explained about the study. They were informed to take small breaks whenever they desired in between the tests.

First pure tone audiometry test was carried out in a sound treated chamber to eliminate hearing loss in group 1 participants and to eliminate conductive hearing loss in participant of group 2. In pure tone audiometry test we conducted both air conduction and bone conduction tests. In group 2 participant we conducted tympanometry test to eliminate the middle ear pathology if any.

After completing these test we started conducting digit span test in auditory modalities only. We seated all the participants in a sound treated room. We started presenting digit in sequencing manner through the audiometer by using speech stimuli. The intensity of the signal was kept constant at 20 dB SL of PTA level for both group 1 and 2 participants. Each digit was presented at a constant manner of one digit per seconds. First forward digit span was carried out and after that backward digit test was carried out. The test procedure was same for each participant in this study.

Again after a gap of 5 minutes we started applying digit span test in visual modalities. In visual modalities test the entire digit appears in a white back ground screen in a video format. In this test digit appears in the screen at a rate of one digit per second. The participant has to seat in front of laptop. Any patient having vision problem were allowed to wear corrective lenses during these tests. Only 7 participants of group 1 wore the corrective lenses during these tests.

Backward digit span test was carried out followed by forward digit span. Total test procedure completed within 45minutes of time.

RESULTS :

We used SPSS software for data analysis. The mean value of forward digit span test in normal hearing by auditory modality was 11.50 (S.D 1.70; Range: 8-14) and visual modality was 8.70 (S.D 1.83; Range: 4-12). The mean backward digit span in auditory modality was 6.28 (S.D 2.09; Range:3-12) and in visual modalities mean was 5.62 (S.D 1.99; Range: 3-12).The mean pure tone average (PTA) for the young adults was 20 dB HL (*S.D*: 3.29; Range: 15-25 dB HL).

Table 1 shows the mean and the standard deviation of the younger adults' performance in the forward and backward digit span test by using two modalities.

Variables	Mean	Standard Deviation
Age	21.42	2.49
Forward DST Visual mode	8.70	1.83
Backward DST Visual Mode	5.62	1.99
Forward DST Auditory mode	11.50	1.70
Backward DST Auditory mode	6.28	2.09
Pure Tone Average	20	3.29

Table 1: *Mean and standard deviation of digit span test in normal hearing populations.*

The mean value of forward digit span test in elderly adult having hearing loss by auditory modality was 10.19 (S.D 1.66; Range:6 -12) and visual modality was 8.71 (S.D 1.95; Range: 4-12). The mean backward digit span in auditory modality was 5.86 (S.D 1.10; Range:4-8) and in visual modalities mean was 5.95 (S.D 1.39; Range: 3-8).The mean pure tone average (PTA) of both ear for the elder adults was 37.88 dB HL (*S.D*: 15.40; Range: 27.5-83.5 dB HL).

Table 2 shows the mean and the standard deviation of the elder adults' performance in the forward and backward digit span test by using two modalities.

Variables	Mean	Standard Deviation
Age	62.29	4.93
Forward DST Visual mode	8.71	1.95
Backward DST Visual mode	5.93	1.39
Forward DST Auditory mode	10.19	1.66
Backward DST Auditory mode	5.85	1.10
Pure Tone Average	37.88	15.40

(**Table 2:** *Mean and the standard deviation of the elder adults' performance in the forward and backward digit span test by using two modalities)*

We use Pearson Correlation test to find out the correlation between various variable. In elder adult having hearing loss; age is negatively correlated with forward digit span test using auditory *(r= -0.68*, p< 0.01) and visual modality (*r= -0.73*, p< 0.01). Age is also negatively correlated with backward digit span test using auditory modality (r= -0.46, p< 0.01) and visual modality (r= - 0.60, p<0.01). Pure tone average is negatively correlated with forward digit span test ($r= -0.64, p<0.01$) by using both auditory and ($r= -0.72, p< 0.01$) visual modality respectively. Here we also found the statistically significant correlation in backward digit span in auditory modality ($r= - 0.47, p < 0.01$) and visual modality ($r=-0.64, p<0.01$).

	Forward DST Visual mode	Backward DST Visual mode	Forward DST Auditory mode	Back ward DST Audit ory mode
Age	-0.73^{**}	-0.60^{**}	-0.68^{**}	-0.46^{**}
PTA	-0.64^{**}	-0.45^{**}	-0.72^{**}	-0.47^{**}

** Correlation is significant at the 0.01 level (2-tailed)

Table 3: *Correlation between PTA, Age with Forward and Backward DST by using both modalities.*

DISCUSSION :

Digit span test is a test for working memory. The digit span test is a very short test that diagnoses cognitive abilities of person. It is frequently used in hospitals and physicians' offices in order for a clinician to quickly evaluate whether a patient's cognitive abilities are normal or impaired. From this study we found greater digit span test result in auditory modality in compare to visual modality. As we know digit span test are mainly used for auditory memory test we did not found any improve score when we used visual mode of presentation in both forward and backward digit span test (DST). We got better result when digits were presented through auditory modality.

Age is another factor which affects the scoring of DST. In this study we did not found any correlation of age and DST in younger adult. That may be due to the limited age range we took in our study. But in older adult we found a strong correlation of age and DST in both of the modalities. We found a decreasing digit span score with increasing age.Working memory is somewhat affected due to the hearing loss of patients. In this study we also found negative correlation of hearing loss and digit span score in both modalities.

With increasing degree of hearing loss we found a decreased score of digit span test. We did not found any correlation of scoring and gender. But found a significant difference in educated and uneducated people in our study. Educated people have a high scoring in DST compare to uneducated people in older adult population. In younger adults we did not took any uneducated person for this study.

CONCLUSION:

We should consider these above factors when we use the digit span test. Age, Hearing loss, Education level generally affect the scoring of digit span test. As digit span test is a auditory memory test we should use auditory modality for scoring. If Auditory Working Memory Capacity has the potential to influence speech processing ability and apparently the amplification, then it seems admissible that the Audiologists may seek ways to assess AWM in the clinical setting.

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IMPACT OF HEARING AID USAGE ON EMOTIONAL AND SOCIAL WELLBEING IN PERSONS WITH SEVERE TO PROFOUND HEARING LOSS

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INTRODUCTION

Hearing loss is one of the major constituents of disability, yet impact of hearing loss on mental health is not widely explored. Hearing loss ranges from mild (10 to 25%) to profound (upto 100%) category of disability. Apart from difficulty of interpreting day to day conversation these individuals also face remarkable amount of socio-emotional challenges. These challenges impact mental health and quality of life. Changes in personality and social isolation are often observed in those individuals with hearing loss who are not aurally rehabilitated. Increased amount of stress can lead to the fear of losing relationship or social standing can have huge emotional impact. These stressful situations can impact mental health as well as general health of an individuals.

There are plenty of literature highlighting varying impact of hearing impairment on mental health as well as Quality of life (QOL) in western population**.** Weinstein (2016) investigated buffering effect of hearing aid use on perceived social and emotional loneliness in US population in the age range 62-92 years and they found a significant change in feeling of loneliness after 4-6 weeks of hearing aid use in individuals who had moderate to severe hearing loss [1]. Mondelli et al., (2012) found significant improvement in QOL mainly in leisure activities in elder adults in Brazilian population in age range 60-90 years but there were no significant changes in the frequency of negative feelings, even after the hearing aid fitting. The patients continue to have such negative feelings [2]. Barbosa et al., (2015) evaluated the impact of Hearing aid fittings among elderly patients in northern region of Brazil over aged of 65 years through Hearing Handicap Inventory for Elderly questionnaire, they found that use of hearing aid significantly improves the hearing handicap, but some older adults still maintain social and emotional limitations[3].

Existing literature suggests that impact of hearing impairment especially severe to profound degree can trigger varying level of socio-emotional anxiety among hearing aid users. Besides, the socio-personal configuration within Indian community is highly varying compared to the western population [4]. The attitude and acceptance of hearing disability are also society specific [5]. The stress coping strategy are also widely varying across different communities. Based on these observations the need for investigation of socio-emotional perspective in individuals with severe to profound hearing loss, who use hearing aid was identified.

The primary objective of this research was to check whether the mean emotional score (rating) and mean social score (rating) were different for person with HAU when compared with NHAU. Furthermore, it was also aimed to check whether scores were different across age and gender. In this study the participants were individuals with hearing loss in the age range of 40-60 years. These individuals were categorized in four categories at interval of five years i.e., 40-45 years, 46-50 years, 51-55 years and 56-60 years. It was also aimed to investigate whether age of onset of hearing loss the age range of 40-60 years has any impact on overall quality of life.

METHOD AND MATERIALS

Participants: A total of 60 individuals (15 females and 45 males) with severe to profound hearing loss in the age range of 40-60 years (mean age of 53.4± 6.07) participated in this study. Out of which 30 individuals (7 females and 23 males) with mean age 53.5 ±6.7 were using hearing aids (HAU) and another 30 individuals (8 females and 24 males) with mean age 53.3 ±5.4 years were not using any mode of amplification (NHAU). Twenty five out of 30 hearing aid users were using behind the ear (BTE) and five were using receiver in the canal (RIC) hearing aids. Twenty-four bilateral (B/L) and six unilateral (U/L) hearing aid users participated in this study. Refer **table 1.**

All participants were examined by an audiologist. Pure tone audiometry, speech reception threshold, and speech detection threshold tests were performed. Individual having sensorineural and mixed hearing loss with severe to profound deafness (41-90db); hearing amplification using digital hearing aid with at least 6 months of hearing aid usage were included. Any individual with any comorbid conditions such as auditory processing disorders, neurodegenerative disorders, psychological problems such as stress or anxiety or any other critical medical conditions were excluded.

Test material: Hearing handicapped inventory for the adults-short version (HHIA-S) adapted from Ventry & Weinstein (1983) was used in this study[6]. This test was used for the assessment of emotional and social adjustment in adults having hearing loss. A total of 10 questions were asked to both groups (persons with and without hearing aid users) out of which 5 questions consist of emotional and other 5 under social domains. In HHIA-S questionnaire, question number 1,2,4,7 and 9 assessed the emotional and 3,5,6,8 and 9 targeted the social domain. Three-point rating scale was used with a response 'yes' awarded 4 points, 'sometimes' 2 points and 'none' for 0 points. The score of 0-8 suggested "no hearing handicap", 10-24 as "mild-moderate hearing handicap" and 26-40 as "significant hearing handicap".

Procedure: Individuals with severe to profound sensorineural hearing loss were randomly selected from Gurgaon hearing aid center and Best hearing solutions, two leading hearing clinics situated in Gurgaon/Delhi region of India. Demographic information was collected from all participants. Initially Case history and otoscopy were performed on all individuals participated in this study. Individuals with any middle ear pathology and fluctuating hearing loss were excluded. Pure tone audiometry was performed at (250, 500, 1000, 2000, 4000 and 8000 Hz) frequencies and speech audiometry (SRT and SDS) were done through Arphi Proton Dx3 Digital audiometer with TDH 39 headphone. Pure tone average was calculated at 500, 1000, 2000 and 4000 Hz frequencies. All the participants were capable of responding to the questionnaire using verbal mode. Written consent was taken from all participants before administration of the questionnaire. The questionnaire was administered by the qualified audiologist.

RESULTS

Mean emotional score of those individuals with severe to profound hearing loss using hearing aid

(2.08±1.46) and individual not using hearing aid (2.26±1.49) were compared across each other. The mean emotional score was computed by adding the response of question no. 1, 2, 4, 7 and 8 (HHIE-S).The score was computed by adding the response of question from (HHIA-S). Level of significance was tested at (P<0.05) and assuming the two tailed hypothesis. T-test statistical analysis was performed to check wheather these two groups differed significantly. The result revealed that mean emotional score of HAU (2.26±1.49) was not significantly different than the mean score of NHAU (2.08±1.46), [t(1,148)=-0.86, P=.39)]. Refer **Fig 1**

After observing no significant difference in the mean emotional score across group wise that is HAU and NHAU, it was also compared across gender within the groups. In other words, whether the mean emotional score differed across the males and females within the HAU and NHAU groups. T-test was performed at (P<0.05) level of significance to check whether the mean emotional score of gender differed significantly within the groups. For the HAU [t(1,148)=-0.86,P=0.39)] group, the result revealed that mean emotional score of females using hearing aids (2.11±1.36) was significantly better than the mean score of male using hearing aids (2.08±1.4). Subsequently, in the NHAU [t (1,298) =-1.36, P=.39)] group, no statistical significant difference in mean emotional score across gender was observed. The mean emotional score of males (2.08±1.49) was significantly not different than females (2.09±1.4) who were not using hearing aid despite severe to profound hearing loss [t (1,148) =-.158, P=0.87]. Refer **Fig2.**

Mean social score of individuals with severe to profound hearing loss was compared across HAU (2.53±1.32) and NHAU (2.54±1.38) groups. The mean social score was computed by adding the response of question no.3, 5, 6, 9 and 10 (HHIA-S). Level of significance was tested at (P<0.05) and assuming the two tailed hypotheses. The T-test statistical analysis was performed to check whether these two groups differed significantly. The result revealed that mean social score of HAU (2.53±1.32) was not significantly different than the mean score of NHAU (2.54±1.38) [t (1,148) =-2.45, P=0.15)]. Refer **Fig 3.**

After observing no significant difference in the mean social score across group wise that is HAU and NHAU, it was also compared across gender within the groups. In other words, whether the mean social score differed across the males and females within the HAU (2.53±1.32) and NHAU (2.54±1.38) groups. T-test was performed at (P<0.05) level of significance to check whether the mean social score of gender differed significantly within the groups. For the HAU [t(1,148)=-0.92,P=0.35)] group, the result revealed that mean social score of females with HAU (2.7±1.15) was significantly better than the mean score of male with HAU (2.4±1.37). Subsequently, in the NHAU [t (1,148) =-2.45, P=.35)] group, statistical significant difference in mean social score across gender was observed. The mean social score of females (3.00±1.11) was significantly different than males (2.38±1.45) who were not using hearing aid despite severe to profound hearing loss. Refer **Fig 4.**

Mean emotional and social score of those individuals with severe to profound hearing loss HAU and individual NHAU were compared across the age categories across two groups (Group A using HA and Group B Not using HA). Level of significance was tested at (P<0.05) and assuming the two tailed hypotheses. T-test statistical analysis was performed to check whether these two groups differed significantly. The result revealed that social and emotional mean score across the age categories (p=0.026) were significantly differed across the age categories. Mean social score was higher than emotional score. In the age range of 46-50, 51-55 and 56-60 years social score significantly higher than emotional score. Refer **Fig 5.**

DISCUSSION

In the present study socio-emotional aspects of QOL was investigated among individuals with severe to profound hearing loss which were equally categorize into two groups, one using hearing aid and other not using hearing aid. Based on the obtained data analysis it was found that mean emotional score and mean social score were not significantly different across the two groups. However, the mean social score of females in person using hearing aid category was significantly better than males. Furthermore, the mean emotional score of females were higher than the males in the HAU category**.** The mean emotional and social score were also investigated across the four age categories of the individuals ranging from 40 to 60 years which consisted of 40-45, 46-50, 51-55 and 56-60 years. The mean social score of the overall participants (HAU and NHAU group) was significantly higher than the mean emotional score. However, no such advantage was observed between the HAU and NHAU group.

As evident in this study, the rationale behind non-significant impact of hearing aid uses on social and emotional domain on the participants with hearing aid user could be several. The aural rehabilitation with hearing aid addresses the functional hearing impairment of the person with not significantly improving the socio personal perspective of the individuals [7].In this study, those participants were included who were rehabilitated with hearing aid within 6 months. Less than six months of HA usage may not be sufficient to establish the socio-emotional domains which get severely shaken by the impact of severe to profound hearing loss.

Hearing loss if persists for longer duration in the elderly population, often results in withdrawal from a variety of social activities. Such isolation behavior may affect socio-personal aspect of life as well as quality of life. Reduced auditory and intellectual stimulation may give rise to changes in the central nervous system and it may affect the development of cognitive decline and dementia [8]. Literature review on hearing loss or poor speech recognition score has been found associated with overall wellbeing [9]. Significant decline in feeling of loneliness and isolation has been reported within 4 to 6 weeks of hearing aid uses in older person with moderate to severe hearing loss [1,10]. Thus, prolonged unaided hearing threshold can induce gradual reduction in overall quality of life[11].

The findings of this study advocate the need for investigation of social and emotional wellbeing in persons with severe to profound hearing loss who are using hearing aid. The impact of severe to profound hearing loss can induce differential level of mental health challenges. Similarly, socio emotional stress caused by hearing disability can induce varying level of challenges across the increasing the age range[12]. Furthermore, family support, individual stress coping strategies socio-personal-professional engagement and previous experience also could be the confounding variables in manifestation of stress related symptoms. Thus, a comprehensive rehabilitation program is advocated for individuals with severe to profound hearing loss which should include audiological intervention along with socio-emotional augmentation[13].

Further research shall focus on the impact of socio-emotional health in those individuals who's hearing aid usage duration is over 6 months onwards. As in literature, long term effect of hearing aid uses on mental health is not comprehensively documented. Secondly, socio-emotional health of individuals with mild to moderate hearing loss shall be investigated, as in this study only severe to profound hearing loss individuals were included.

CONCLUSION

Main objective of this research was to check whether the mean emotional and social score were different for person with HAU when compared with NHAU. Results showed that mean social score was higher than emotional score across the age categories in both HAU and NHAU groups but when compared across the gender females emotional and social score was better than males in HAU group only social score was better in females than males in NHAU group. It was evident that the recovery pattern of social and emotional component occurs distinctly. These findings can assist in client specific counselling shall be developed for socio-emotional adjustment in case of acquired hearing loss occurs distinctly.

CONFLICT OF INTEREST: None declared.

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MATURATION OF BINAURAL INTEGRATION ABILITIES: A CROSS SECTIONAL STUDY ACROSS AGE

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Abstract

Binaural integration is a cognitive process involving the fusion of various auditory information presented binaurally. It is considered important for speech perception and sound localization. Binaural integration is usually assessed using dichotic tests. There are limited studies that have attempted to determine the effect of age on the perception of binaural integration abilities. The aim of the study was to assess binaural integration abilities across children, adolescents and adults using the Dichotic CV test. In the present study, thirty children in the age range of 8-11.11 years, 30 adolescents in the age range of 12-17.11 years, and 30 adults in the age range of 18-25 years were included. The dichotic consonant vowel test (DCV) was performed on both the groups using dichotic presentation of the consonant-vowel (CV) syllables [pa], [ba], [ta], [da], [ka] and [ga]. The right single correct scores (R-SCS) and left single correct scores (L-SCS) and double correct scores (DCS) were calculated and compared between the groups.The study results showed that the dichotic CV scores increased across age, and children obtained the lowest scores, followed by adolescents and adults. Thus, the results of the study show that the binaural integration abilities increase with age and reach adult-like scores by the age of 12 years. This is consistent with the neurophysiological studies which report that temporal cortex is matured and adult-like by the age of 12 years.

Key Words: *Binaural integration, Dichotic***,** *Consonant Vowel (CV) nonsense syllables, Temporal cortex.*

INTRODUCTION:

Binaural integration is a cognitive process involving the fusion of auditory information which is presented binaurally. It is considered important for speech perception and sound localization. Binaural integration is usually assessed using dichotic tests (Bellis, 2002). Speech stimuli used for assessing binaural integration include consonant vowel (CV) nonsense syllables, digits, spondees, and sentences among which Dichotic CV is the most common. There are limited studies that have attempted to determine the effect of age on binaural integration abilities. Previous studies on binaural integration show that the scores are better in right ear compared to left ear (Martin, Jerger & Mehta, 2007; Westerhausen et al. 2009; Moncrieff & Wilson, 2009). There are some studies which report that right ear advantage reduces with increase in age (Bryden & Allard, 1981; Fennell, Satz, & Morris, 1983).

However, there are no studies which have attempted to check the effect of age on binaural integration abilities in adolescents and adults. There is a need to determine age of maturation of binaural integration abilities in individuals with normal hearing sensitivity. Hence, the aim of the study was to assess binaural integration abilities across children, adolescents and adults using the Dichotic CV test.

METHODOLOGY:

In the present study, thirty children in the age range of 8-11.11 years, 30 adolescents in the age range of 12-17.11 years, and 30 adults in the age range of 18-25 years were included. All the participants had no history of any otological, neurological or metabolic disorders. The participants had normal hearing sensitivity defined by pure tone thresholds within 15 dB HL in the frequency range 0.25 to 8 kHz. All the participants were examined for middle ear status using immittance meter which resulted in 'A' type tympanogram and acoustic reflexes present at 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz. Pure tone audiometry was done using a two channel diagnostic audiometer. Immittance evaluation was done using a calibrated diagnostic middle ear analyzer.

The dichotic consonant vowel test (DCV) was performed on both the groups using dichotic presentation of the consonant-vowel (CV) syllables [pa], [ba], [ta], [da], [ka] and [ga]. The participants of the study were asked to note down both the syllables heard. Based on the responses, the number of correct responses were determined. The right single correct scores (R-SCS) and left single correct scores (L-SCS) and double correct scores (DCS) were calculated and compared between the groups.

RESULTS AND DISCUSSION :

A descriptive statistical analysis was done for the collected data and the mean and standard deviation of DCS, R-SCS and L-SCS was determined. The study results showed that the dichotic CV scores increased across age, and children obtained the lowest scores, followed by adolescents and adults. The mean and SD of the R-SCS, L-SCS and DCS are for all the three groups is shown in Figure 1.

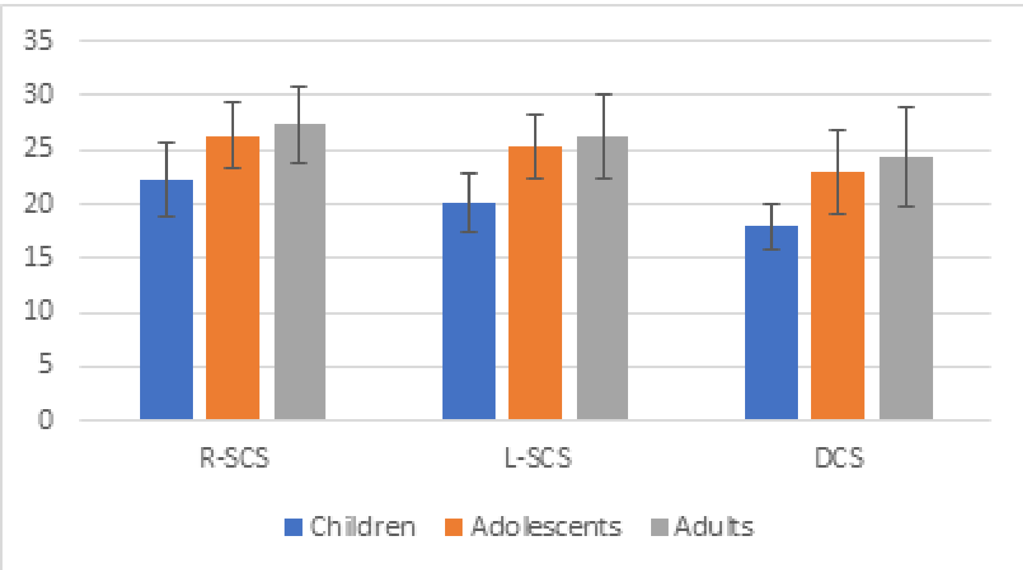

Figure 1: *Mean and standard deviation (SD) of R-SCS, L-SCS and DCS for children, adolescents and adults.*

ANOVA with Tukey's post hoc test showed that the children scored significantly lower scores ($p<0.05$) than adolescents and adults. However, there was no significant difference ($p>0.05$) in scores between adolescents and adults. Similar results were obtained for both right and left single correct scores and double correct scores. Thus, the results of the study show that the binaural integration scores increase with age and reach adult-like scores by the age of 12 years. This is consistent with the neurophysiological studies which report that temporal cortex is matured and adult-like by the age of 12 years (Bellis, 2002; Musiek, 1983; Jerger & Musiek, 2000). The results of the study are essential to understand the developmental trend for the perception of binaural integration abilities. This information can be used effectively while interpreting the test results in a disordered population.

CONCLUSIONS

The results of the study are essential to understand the developmental trend for the perception of Dichotic CV test. The results show that the binaural integration abilities improve with age and become adult like at the adolescent age. This information can be used effectively while interpreting the test results in a disordered population.

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EFFECT OF CONCURRENT COMPETING TASK ON PERFORMANCE OF RECALL

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Abstract

Cognition is important for information processing, it includes processes such as memory, attention, reasoning and justification. Memory helps in retention of information. It includes processes such as encoding, storage and retrieval. Recall refers to the retrieval of information. The current study was carried out with the aim of investigating the effect of concurrent competing task on recall. The concurrent competing task would impose demands on encoding of information, hence the relationship between the concurrent competing task on recall was investigated. A total of 50 participants participated in the current study. The participants were divided into two groups. For group 1, concurrent competing task was administered along with the recall task. For group 2 only recall task was administered. Group 2 performed better than group 1 and the difference was significant statistically showing that the competing concurrent task would affect the performance even in neuro typical adults.

Key words: *Divided attention, Competition, Recall*

INTRODUCTION:

Cognition can be defined as the process an organism uses to organize information. As stated by Matlin (2005), "it is a mental activity which describes the acquisition, storage, transformation and use of knowledge". Cognition involves spectra of mental processes such as attention, memory, language, reasoning, pattern recognition, problem solving, organization of information, concepts and classification. Memory is one of the important aspects of cognition. Functions of memory allows to recall what we know and help us to learn new information. "Memory is the process in which information is encoded, stored and retrieved" (The process of binding information to the senses from the outside world is known as encoding which is the first stage of memory. Storage is the second stage of memory process and this entails that information is retained over a long period of time. Third stage is the recall or retrieval of the information that has been previously stored. In certain instances, a single exposure to an event or information is adequate enough for a memory trace to be encoded, stored and then recalled. However, the information that is stored is much less likely to be forgotten if it can be repeatedly re-encoded from the surroundings and/or re-activated within the memory system through a process called consolidation. Hippocampus is the area of brain which combines different pieces of information to generate a single memory trace during encoding and regions within the pre frontal cortex are responsible for recall of this memory trace (Lum, Ullman & Conti-Ramsden, 2015).

Recall in memory implies the re-accessing of experience or events from the past, which has been encoded and stored in the brain. It involves remembering of information, events or objects that is not physically present at the moment. Human long-term memory consists of traces of many thousands of words, pictures, episodes and other types of information and hence retrieving or recalling this information is challenging. Due to these factors recent research has been focusing considerably into recall abilities, which is the final stage of memory. Simple tasks such as recalling a telephone number to complex tasks as like memorising a paragraph of a poem or formulation of a new sentence by using a key word would require active contribution from Memory. Memory is a cognitive function which is pivotal in our day-to-day life. Memory is assumed to involve three stages such as encoding, storage and Recall.

Language and cognition are highly interdependent. Simple tasks such as recalling a telephone number to complex tasks as language comprehension, formulation and production require the need to store and retrieve information in the correct order (Lewandowsky, Brown, Wright &Nimmo, 2006). Memory processes and language functions are intricately connected where language involves use of an arbitrary set of symbols (code) arranged in a prescribed manner to convey meaning. However verbal memory and language are interdependent on each other. Prior to the storage of an item in the long-term verbal memory, it must be decoded and recognized as a linguistic item with phonological and/or semantic characteristics. The ability to retrieve an item from verbal memory depends upon the access to the verbal representation of the item. Thus, language is the medium through which these lasting impressions are conveyed at a later time. On the other hand, one way in which language is dependent upon verbal memory is that vocabulary is learned via verbal-memory functions. The acquisition of a new word and its meaning requires the use of verbal memory to enter the item into more permanent semantic storage.

Before an item can be stored in long-term verbal memory, it must be decoded and recognized as a linguistic item with phonological and/or semantic characteristics. The ability to retrieve an item from verbal memory depends upon the access to the verbal representation of the item. A cognitive dual refers to a competent task which runs parallel to a main task. The stimulus of a concurrent task is called as aconcurrent stimulus or a competing stimulus. The competing stimulus may offer competition at the stage of encoding. As the concurrent stimulus is running parallel to the main stimulus encoding would become difficult and as a result performance of the main task can get affected.

Need for the study: Recall task assesses for memory. It is the final stage of memory processing. The current study was carried out with the aim of investigating recall ability in the presence of a competent concurrent task. The concurrent task was administered in parallel to the primary task. Hence the study was an attempt in investigating the relationship between cognitive dual task requiring divided attention with the recall task.

Aim of the study: The study aims to investigate the effect of competing/concurrent stimulus on recall of items in young neuro-typical adults.

Objectives: To compare the performance on auditory recall as a primary task with the performance on auditory recall with concurrent competent task

METHODOLOGY

Participants: A total of 50 participants were recruited for the study. Equal number of males and females were recruited. The mean age of the participants was 19.3 years. The participants were divided into two groups. The participants did not have any history of communicative, cognitive and sensory problems. The participants had normal vision or near normal visual acuity. All the participants were native Malayalam speakers, however the task was carried out in English and the participants had native like proficiency in the second language.

Structure of the task: The primary and competent task was administered on group 1 while only the primary task was administered on group 2 participants. A primary task and a concurrent task were administered on the participants of group 1. Auditory recall was the primary task while copying geometrical shapes was the competent task. The competent task emphasized on visual modality while the main task tapped the auditory modality.

Stimulus: Recall list was created for the study. The stimulus set had 6 words. There were four such stimulus sets. The items were semantically unrelated to increase the complexity of the task. The words had 7 to 8 phonemes basically again a strategy to increase the complexity of the task.

Procedure: The participants were asked to start with the concurrent task where they were asked to copy the geometrical shapes. The stimulus for recall was in English, L2 of the participants. All participants had native like proficiency in the second language. Each stimulus set had 5 items and there were four such stimulus sets. The participants were given the flexibility of recalling the items in any order they wish thus the task was a free recall task. The maximum score on recall task was 20.

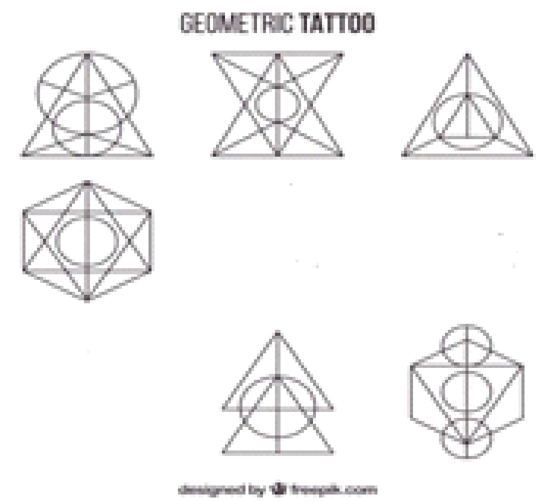

Figure 1: *Competent task, copying the geometric shape*

Scoring: Each correct response was given a score of 1, the recall was free recall where the participants were allowed to recall the items in any order they intended to. The number of items recalled correctly was given weightage.

RESULTS AND DISCUSSION:

The mean scores for group 1 and group 2 were computed. Group 1 participants secured a score of 12 while group 2 participants secured a score of 16. For group 1 participants, completion of the concurrent task was also a yardstick. 19 out of 25 participants of group 2 could complete 75% of the concurrent task.

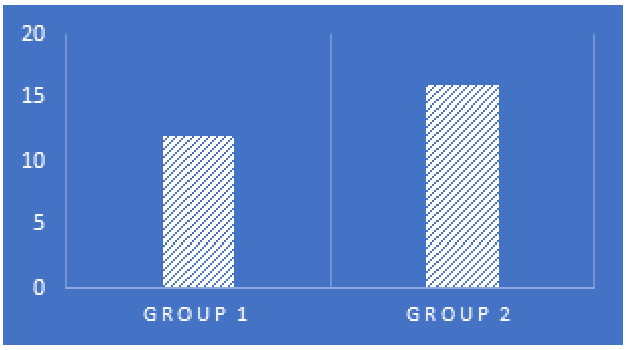

Figure 2: *Comparing the performance of group 1 and group 2*

The performance of group 1 and group 2 was compared. The primary task and the competent task were administered on group 1 while only the primary task was administered on group 2. Thus, the performance on cognitive dual task was poorer than the recall task.

In order to verify if there was any significant difference between group 1 and group 2, Mann Whitney U test was used (as the data did not abide by the properties of normal distribution as proven by Shapiro Wilk's test of normality. The Z score obtained on comparison was 3.23 ($p<0.05$). The corresponding p value showed significant difference between group 1 and group 2.

The correlation between the completion of concurrent task and performance on recall was not carried out as it was not the primary objective of the study. This objective will be addressed in future paper. The overall result showed that the concurrent competing stimulus altered the performance on recall. The concurrent competing stimulus can affect the encoding of the auditory stimulus thus can be variable affecting the results. Even in young neuro typical adults, the effect of competing stimulus on the performance of recall was evident. The competent visual stimulus required divided attention while the performance on recall required selective attention. Even the normal neuro typical participants confronted difficulty on performing the recall task. Thus, it can be inferred that cognitive dual task would offer inhibition to the performance on recall task.

CONCLUSION:

The study was carried out with aim of investigating the effect of concurrent competing stimulus in other modality on the performance on recall. The participants were divided into two groups. The concurrent task and primary task were administered on first group, where as only the primary task (recall) was administered on second group. The results suggested that the concurrent stimulus in other modality can offer competition in encoding and thus can affect the performance even in young neuro-typical adults.

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COMPARISON OF QUALITY OF LIFE OF NON HEARING AID USERS VS HEARING AID USERS IN MIDDLE AGED HEARING IMPAIRED POPULATION

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Keywords: *Quality of life (QOL), Middle age, Non Hearing Aid users (NHAU), Hearing Aid Users (HAU)*

INTRODUCTION

Hearing is an essential sense in life, performing an important role in society because it is the basis for the development of human communication. Normal hearing sense is important for social, emotional, psychological, and communicative realms. A subject who has auditory disability may also suffer damage in his social, psychological and professional life, leading to feelings of insecurity, fear, depression, isolation and tension in the family environment, owing to lack of attention that hearing disabled people normally have.

According to WHO estimated number of people with disabling hearing loss in 2018, 466 million person in the world (6.1% of the world's population), 432 million (93%) of these are adults (242 million males, 190 million females), 34 million (7%) of these are children. The prevalence of hearing impairment (HI) in India is around 6.3% (63 million people suffering from significant auditory loss). The estimated prevalence of adult-onset deafness in India is 7.6% and childhood-onset deafness is 2%.Hearing impairment is a disability that can affect the effective functioning of the total personality no matter the period of onset. [1]

The impacts of hearing loss may also have positive or negative influences on aspects related to health care, socio-demographic and clinical factor. As a consequence of hearing loss, difficulties in communication, social isolation, depression and negative feelings can be mentioned that can directly affect the QOL and the perception that the individual has of their health status.[2]

Hearing loss and related problems decrease QOL and lead to isolation from social life. The primary audiologic intervention for adult-onset hearing loss is the use of amplification through hearing aids, which is aimed at reducing the auditory impairment, optimizing the individual's auditory activities, and minimizing participation restrictions.[3](Kiessling J,. 2003).Patient satisfaction with Hearing aid use is the key factor in determining treatment success. Several studies have shown positive associations between degree of hearing loss and subsequent use of hearing aids (Surr et al, 1978.).

QUALITY OF LIFE (QOL) is the general well-being of individuals and societies, outlining negative and positive features of life (Forbes septembter13).QOL includes everything from physical health, family, education, employment, wealth, safety, security to freedom, religious beliefs, and the environment. [4]

The evaluation of QOL is multidimensional: physical well-being, material well-being, social well-being, and emotional well-being .[5] This is due to the fact that several studies have already demonstrated that adult hearing-impaired individuals may have a negative effect on QOL and psychological well-being – social isolation, depression, anxiety, and even cognitive decline have been reported in affected persons,[6] so it important estimate patient-reported outcome measures, such as QOL questionnaires, should ideally be systematically implemented in health care practices (Wehrlen L, 2016).

Hearing impairment affects individuals of any age range and its onset can be congenital or acquired but the acceptance of hearing loss during adulthood leads to more psychological trauma than adjusting and living with the hearing loss from the early years of life. This is a very crucial time period in any human life in which individual accomplishes their dreams and responsibilities, including home and mate, establishing a family or circle of friends, and selecting an appropriate occupation The impact of hearing loss in middle-aged hearing-impaired individuals affects the material well-being, health and relationship with relatives and spouse as it limits the extent to which they can help others, their civic activities, occupational role, and socialization.

Hence it would be interesting, to assess and compare the Quality of life (QOL) of Non-hearing aid users Vs Hearing aid users in the middle-aged hearing-impaired population and to know whether the usage of hearing aid improves the quality of life.

METHODOLOGY

Data for the studycollected in 2 months from May3rd toJuly 3rd 2021 from a private clinic"LISTENING EAR'S PASCHIM VIHAR (New Delhi)".A post-test control group study, total number of 50 middle-age participants (including male /female) selected with a randomized sampling of age range 35 to 55 years (mean age of 39.20±6.6) were divided into two groups: (Non-hearing aid users) NHAU and hearing aid users (HAU) with the following **Inclusioncriteria**: Individuals have variousdegree of hearing impairment: Moderate to Severe , minimal period of hearing aid usage ≥ 3 month, age range of 35 yearsto 55 years ,Individuals fitted binaurally with hearing aid and **ExclusionCriteria of the study:** Individual's age below 35years ,Hearing aid usage period ≤ 3 months individuals with multiple impairment,Congenitally hearing impaired individual ,Individuals with unilateral impairment. ,Monaurally fitted hearing aid

HHIA-H (Hearing Handicap Inventory for Adults-HHIA) was used by the Researcher in Hindi language that have been translated and culturally adapted by Sood R, Kumar A, Tyagi AK (2019) and the adapted versions have high internal consistency and were reliable and valid.The adapted HHIA-H was administered to participants who met the inclusion and exclusion criteria. The HHIA consists of 25 questions. Thirteen of the questions the emotional sub-group, and 12 of them form the social/ situational sub-group. The questions in the Emotional (E) subgroup evaluate the subjective thoughts of an individual regarding the reactions of the people around him/her relating to of his/her hearing difficulty. The questions in the Social (S) sub-group assess the perceived effects of hearing loss in various social situations.

A briefcase history about the participant including Demographic details, other assessments details like PTA (500Hz, 1 kHz,2 kHz) were taken from the patient's record file. With the Informed consent of the participant, the administration of questionnaire HHIA-H was done. The HHIA-H was administered to the participants of (NHAU) and (HAU) groups. The HHIA questionnaire was administered in an interview fashion where the researcher asked questions to the participant and marked the same response on a printed questionnaire sheet as reported by the participants in the form of given options " YES, SOMETIMES, NO."

Each "yes" response was given 4 points, "sometimes" was given 2 points, and "no" was given 0 point. The total points are between 0-100. It provides scores ranging from 0 to 48 and 0 to 52 for social and emotional subscales, respectively, and combined scores ranging from 0 to 100 with higher scores indicating greater perceived hearing handicap and lower scores indicating less difficulty/handicap. Interpretation of score: 0–16 %suggests: no hearing handicap which indicates "good" QOL, 18– 42% suggests: mild-moderate which indicates "fair" QOL and 44+% suggests significant hearing handicap which indicates "poor" QOL

STATISTICALANALYSIS:

The results of the current study were tabulated subject and group wise and analyzed using statistical package for the social sciences (SPSS V26.0). The mean, standard deviation, T test, were administered on the data .

RESULTS : NHAU (PTA in dBHL) HAU (PTA in dBHL) RIGHT EARLEFT EARRIGHT EAR LEFT EAR 63±15.9164.26±16.0164.21±15.2764.54±15.08 As the sample size comprised of 50 participant 25 were NHAU and, 25 were HAU, with the mean of 20.68±19.36 (in months) average duration of hearing aid usage by the hearing aid users. The study consist of bilateral symmetrical 60% sensorineural, 12% conductive and 28% mixed hearing impaired subjects. The mean PTA of right and left ear are summarized in the following table.

Table -1 *shows the mean of PTA of right and left ear of NHAU and HAU group*

*PTA: Pure tone average threshold

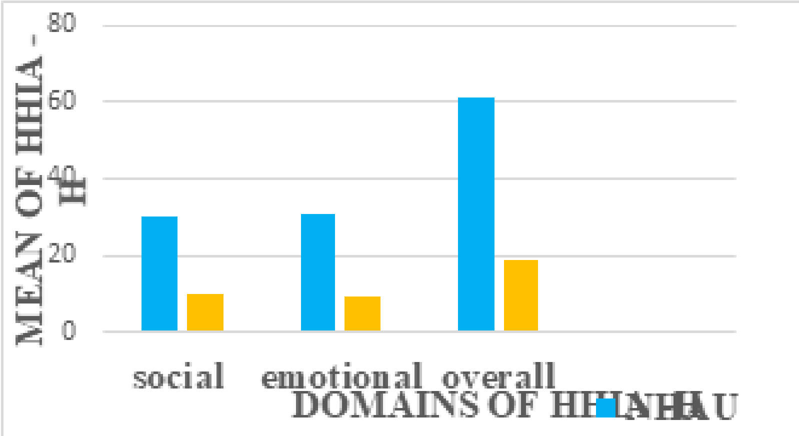
NHAU (PTA in dBHL)		HAU(PTA in dBHL)	
RIGHT EAR	**LEFT EAR**	**RIGHT EAR**	**LEFT EAR**
63±15.91	64.26±16.01	64.21±15.27	64.54±15.08

Table -2 *Shows, the mean, Standard Deviation, P & T values of thesocial, emotional and overall scores obtained in social, emotionaldomain and overall QoL using HHIA –H in both the groups*

DOMAIN OF HHIA -H	GROUP	MEAN	S.D	T VALUE	P VALUE
SOCIAL	**NHAU**	30.40	10.37	8.17	0.00
	HAU	10.16	6.75		
EMOTIONAL	**NHAU**	30.72	5.35	10.96	0.00
	HAU	9.20	8.22		
OVERALL QoL	**NHAU**	61.12	14.75	10.42	0.00
	HAU	19.04	13.76		

MEAN OF HHIA -H DOMAINS OF HHIA -H NHAU Graph 3:Comparison of mean of social, emotional and overall scores obtained in HHIA-H between NHAU and HAU groups HHIA –H was done in both the groups, the mean of social, emotional, and overall scores obtained in the N-HAU group is 30.40, 30.72, and 61.12 respectively with their Standard deviations 10.37, 5.35, 14.75respectively. In the HAU group,the mean of social,emotional and overall scores obtained in HAU group is10.16, 9.20, and 19.04respectively with their Standard deviations6.75, 8.22, 13.76respectively. (As shown in table 2)

An unpaired t-test was done between both the groups to compare and find the significance of difference in between the NHAU and HAU groups. T value is obtained forsocial, emotionaland overall QoL of HHIA –H are8.17,10.9, and 10.42 respectively. (As shown in table 2).



DISCUSSION:

The overall scores of HHIA-H, as well as their social and emotional domains, have higher mean of scores in NHAU as compared to HAU group. The reduced mean of scores of social, emotional, and overall HHIA –H are indicative of better QOL of the HAU group as compared with the N-HAU group in the middle-age hearing-impaired population and it is also correlating with the previous studies of QOL of older adult's hearing-impaired population which were using amplification devices. As per the HHIA-H interpretation in the HAU group, the majority 52 % were found (0-16) % suggestsno handicap that good QOL, 44% were found (18 -42) % suggests mild to moderate handicap indicates fair and 4% were found(44+%) suggests significant handicap indicates poor QOL.In the N-HAU group, 12 % were found suggests mild to moderate handicap indicates fair and 88% were found (44+ %) suggests significant handicap indicates poor QOL.

An unpaired T-test was done, results indicate that the difference between the score of N-HAU Vs HAU group on the HHIA-H, are statistically significant with noted P value is 0.000. Significant differences are also observed in both the social and emotional subscales of the HHIA-H withnoted significance values 0.00, 0.00 respectively in between both the groups. Hence, with the observed results of T-test and HHIA-H interpretations one can conclude that HAU have better quality of life because of the rehabilitation of amplification device, therefore HAU are better dealing with the daily life situations and challenges.

Therefore the present study shows the same results as seen in the various studies of QOL related to hearing impairment.Bipin Kishore prasad et al ,(2020) assessed QOL and hearing aid satisfaction level in a group of one hundred and fourteen (114) hearing handicapped patients,Majority (85%) reported high level of satisfaction in terms of hearing benefit. Patients with severe degree of hearing loss were more satisfied and used the aid for longer duration in a day.

Eman A. Said. (2017) quantifies the QOL of hearing-impaired elderly individuals (HIEI) and assess hearing aids impact on QOL. HAUs perform better in all domains of WHO QOL-BREF Majority of HAUs perform well with significantly higher scores than non-users participants in all items of physical health domain, social items, psychological items of WHO QOL-BREF with significant reductions in emotional, social, and total scores of HHIE in users group compared with Non users indicated improvement in their QOL.

Azahinm (2015) assessed forty individuals with bilateral sensorineural hearing loss, who use unilateral hearing aid for the first time in 40-65 age range There was a statistically significant decrease in total HHIA scores with unilateral HA uses ($P < 0.01$). After 3 months of hearing aid usage, the 95% have had moderate or more benefit with a unilateral HA.

CONCLUSION:

It is having a great importance to improve methods of identifying individuals with deteriorating QOL, thus improving services for providing hearing aids, assistive listening devices, and auditory rehabilitation. Identifying individuals with hearing loss, supplying appropriate hearing aids or other listening devices, and teaching coping strategies may have a positive impact on the QOL of older people.

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APPENDIX

COMPARISON OF QUALITY OF LIFE OF NON HEARING AID USERS VS HEARING AID USERS IN MIDDLE-AGED HEARING IMPAIRED POPULATION

1. DEMOGRAPHIC DETAILS:

Name: Age/sex:

Address

Occupation:

2. PATIENT RECORD

1.Onset:

2. NHAU/HAU:

3. Brief case history:

4. Duration of hearing aid usage

5. Audiological Interpretation:

Hearing Handicap Inventory for Adults: Hindi version (HHIA –H)

एस -1 क्या सुनने की समस्या के कारण आप फोन का उपयोग कम करते हैं ?	हां	कभी कभी	नहीं
ई-2 क्या सुनने की समस्या के कारण आप नए लोगों सेमिलने में शर्माते हैं ?			
एस -3 क्या सुनने की समस्या के कारण आप लोगों के समूह से बचने का प्रयास करते हैं ?			
ई-4 क्या सुनने की समस्या आपको चिड़चिड़ा बनाती है ?			
ई-5 क्या सुनने की समस्या के कारण आप परिबारिक सदस्यों से बात करने से कतराते हैं ?			
एस -6 क्या सुनने की समस्या के कारण आपको किसी पार्टी में शामिल होते समय कठिनाई महसूस होती है ?			
एस -7 क्या सुनने की समस्या के कारण आपको सहकर्मियों क्लाइंट्स और ग्राहकों को सुनने/समझने में कठिनाई महसूस होती है ?			
ई-8 क्या सुनने की समस्या के कारण आप विकलांग महसूस करते हैं ?			
एस -9 क्या सुनने की समस्या के कारण आपको दोस्तों, रिश्तेदारों या पड़ोसियों से मुलाकात करते समय कठिनाई होती है?			
ई-10 क्या सुनने की समस्या के कारण सहकर्मियों या ग्राहकों से बात करते समय आपको चिड़चिड़ापन महसूस होता है ?			

एस -11क्या सुनने की समस्या के कारण आपको फिल्मों या थिएटर में कठिनाई होती है ?			
ई-12 क्या सुनने की समस्या के कारण आपको घबराहट होती है ?			
एस -13 क्या सुनने की समस्या के कारण आप दोस्तों, रिश्तेदारों या पड़ोसियों से जितना मिलना चाहते हैं, उससे कम मिलते हैं ?			
ई-14 क्या सुनने की समस्या के कारण आपका अपने परिवार बालों से झगड़ा होता है ?			
ई-14 क्या सुनने की समस्या के कारण आपका अपने परिवार बालों से झगड़ा होता है ?			
एस -15 क्या सुनने की समस्या के कारण आपको टीवी या रेडियो सुनते समय परेशानी होती है ?			
एस -16 क्या सुनने की समस्या के कारण आप जितनी बात खरीददारी करने जाना चाहते हैं,उसकी तुलना में कम बात जाते हैं ?			
ई-17 क्या आपकी सुनने की समस्या आपको निराश महसूस कराती है ?			
ई-18 क्या सुनने की समस्या के कारण आप अकेला रहना चाहते हैं ?			
एस -19 क्या सुनने की समस्या के कारण आप अपने परिवार के सदस्यों से जितनी बात करना चाहते हैं,उसकी तुलना में कम करते हैं ?			
ई-20 क्या सुनने की समस्या के कारण आपकी व्यक्तिगत या सामाजिक जिंदगी सीमित/बाधित हो रही है ?			
एस -21 क्या सुनने की समस्या के कारण आपको रिश्तेदारों या दोस्तों के साथ रेस्तरां में कठिनाई होती है ?			
ई-22 क्या सुनने की समस्या के कारण आप उदास महसूस करते हैं ?			
एस -23क्या सुनने की समस्या के कारण जितनी बार आप टीवी या रेडियो को सुनना चाहते हैं उसकी तुलना में कम बार सुनते हैं ?			
ई-24 क्या सुनने की समस्या के कारण दोस्तों से बात करते समय आप असहज महसूस करते हैं ?			
ई-25 क्या सुनने की समस्या के कारण आप लोगों के समूह में अकेला महसूस करते हैं			

I agree to use my data for the research purpose:

SIGNATURE:

THE EFFECT OF COVID-19 PANDEMIC ON HEARING AID USERS.

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ABSTRACT

The COVID-19 is a disease caused by a new strain of corona virus. 'CO' stands for corona, 'VI' for the virus, and 'D' for disease, it is coming in different phases and there are different variants in COVID-19like β-coronavirus, alpha and omicron, globally maintaining WHO guidelines like (face mask and physical distance etc). It effects human beings health, wealth and in many ways directly or indirectly. Its affects are also seen to the hearing impaired population in many ways. The hearing aid users suffer with limited access and services due to various restrictions of governing bodies.

To know the COVID-19 pandemic impact on accessibility of audiological services to the hearing aids users and to know the availability of services for hearing aids, COVID19 appropriate behavior on speech communication in hearing aid users.

A face to face interview survey was conducted by using purposive random sampling method. Total of 200 hearing aid users [Male: 116 (58%), Female: 84 (42%)] with an age range 18 years to 70 years were participated in the study.

This study was intended to learn how COVID-19 situations, including lockdowns, restrictions have affected individuals with hearing aid users. The results of this survey study was that 198 (99%) participants out of total 200 respondents indicated that they faced difficulties in reading facial expressions due to speaker wearing masks. And 182 out of the 200 (91%) participants reported that they faced problems in speech comprehension, muffled speech due to speaker wearing masks. And also 156 out of 200, (78%) participants reported that they faced problems due to physical distancing. And also faced difficulties for availability of speech and hearing centre's to get their hearing aid programming, hearing aid up gradation, hearing aid batteries, ear tips, wax guard, ear moulds.

The overall survey results revealed that COVID-19 has negative impacts on Hearing aid Users. The study found that COVID-19 had impacted negatively on Audiological services required for hearing aid users and their communication requirements.

Key words: *Covid-19, Hearing aid, Hearing aid Accessories, Mask, Social Distance.*

INTRODUCTION

COVID-19 is a disease caused by new strain of corona virus. 'CO' stands for corona, 'VI' for the virus, and 'D' for disease. Formerly, this disease was said as '2019 novel corona virus' or '2019-nCoV.' The COVID-19 virus may be a new virus connected to identical family of viruses as severe acute metabolic process syndrome (SARS) Symptoms will embrace Fever, Cough, cold, Shortness of breath or problem respiration, Fatigue, Muscle or body aches, Headache, loss of taste and smell, Congestion or fluid nose, Nausea. The (COVID-19) was first noticed in Wuhan China, in 2019, and afterward unfold globally to become the fifth documented pandemic since the 1918 contagious disease pandemic. The primary official cases of COVID-19 were recorded on the thirty first of Dec, 2019, when the World Health Organization (WHO) was informed of cases of pneumonia in Wuhan, China, with unknown cause. On the Seventh of Jan, the Chinese authorities known a completely unique coronavirus, temporally named 2019-nCoV, because the reason for these cases. Weeks later, the WHO declared the rapidly spreading COVID-19 outbreak as a Public Health Emergency of International Concern on the 30th of January 2020. Various organizations and individuals around the world have faced considerable challenges due to the evolving COVID-19 pandemic. The World Health Organization advises the use of masks as part of a comprehensive package of prevention and control measures to limit the spread of SARS-CoV-2, the virus that causes COVID-19. Other infection prevention and control (IPC) measures include hand hygiene, physical distancing of at least 1 meter, avoidance of touching nose, face.

Whereas the first case reported in India was on January 30th in the State of Kerala with the disease's rapid growth seen in March in most of the parts of India, With the outbreak, the disease has been declared an epidemic and with a burgeon seen in March 2020, the Prime Minister announced one of the India's largest lockdowns ever on 24th March 2020 which saw an extension till 30th of May. The COVID-19 pandemic is still creating difficulties for the people, and especially for persons with hearing impairment, and hearing aid users. Although healthcare professionals are functional during this lockdown period but not every public health care unit were functional. Most of the Audiologists and Speech Language Pathology therapists do not work as they do not come under emergency health workers and Speech and hearing Centre's are nonfunctional during this time. Due to non-functional audiological services, individuals using hearing aid suffered from a crisis of zinc-air batteries with limited dispensing of hearing aids counseling and programming as well as for the troubleshooting of the hearing aids. However, Tele-audiology which facilitates audiological management at a distance, maybe a possible alternative to the temporary cessation of person services. Almost every aspect of audiology, including diagnostic evaluation, hearing screening, hearing aid fitting and verification, and cochlear implant programming, can be performed via tele-audiology.

AIM & OBJECTIVES

To know the COVID-19 pandemic impact on accessibility of audiological services to the hearing aids users and to know the availability of services for hearing aids, COVID19 appropriate behavior on speech communication in hearing aid users.

METHODOLOGY

The study design involved survey method for collecting data. The participants were chosen based on purposive random sampling across the Hyderabad. The study was designed to determine the issues or problems faced by users of hearing aids during the COVID-19 pandemic, using descriptive statistical methods. The study was conducted on 200 hearing aid users [Male: 116 (58%), Female: 84 (42%)] with an age range 18 years to 70 years who have been using hearing-technology during the corona virus pandemic 2019 (COVID-19). All Participants with unilateral or bilateral hearing aids irrespective of type and model of hearing aid were selected for this study.

Study tool and procedure

A questionnaire with close-ended questions was developed in English consisting of statements related to hearing aid user facing difficulties during (COVID-19) pandemic. The questionnaire consists of two sections, the first section consists of demographic details and The second section consists of 20 close-ended questions related to difficulties faced by hearing-technology users during the COVID-19 pandemic. This questionnaire was validated by 3 Audiologists/ASLPs before administration to participants.

The validated questionnaire was administered on 200 hearing aid users in different clinics/ Institutions across Hyderabad, on face-to-face interview after taking an informed consent, The participants were instructed to respond to the questions by selecting one of the options (Yes, No or Sometimes). Responses were collected over a period of three months, and kept confidential.

The collected raw data was computed for further statistical analysis using SPSS statistical software (SPSS v26.0). Descriptive statistics were used to analyse the demographic details/amplification history of the survey, as well as for percentage analysis of various responses to each question.

Age:

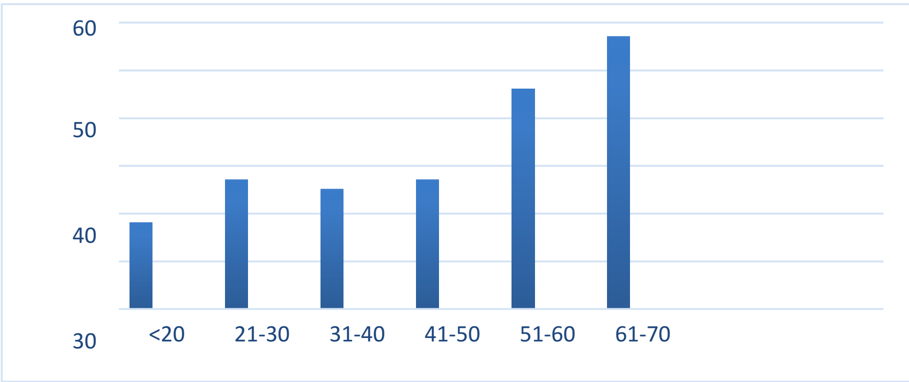

Fig 1.1: *Shows age groups of participants.*

Fig 1.1 Shows the age in the participants were <20 years 18 participants, 21-30 years 27participants, 31-40 years 25 participants, 41-50 years 27 participants, 51-60 years 46 participants, 61-70 years 57participants.

How long using Hearing Aids?

Fig 1.2 *Shows the percentage of individuals How long using hearing aids.*

11	Are you concerned about the increase in the cost of hearing aid maintenance during the pandemic?	45	22.5	95	47.5	60	30
12	Do you face any difficulty related to the availability of public transport during the pa39ndemic?	67	33.5	8	43.5	46	23
13	Are you concerned about Health safety in accessing hearing aid services during the pandemic?	54	27	96	48	50	25
14	Do you face any difficulty in speech-reading due to the speaker wearing masks?	197	98.5	3	1.5	0	0
15	Do you face any difficulty in reading facial expressions due to masks?	192	96	8	4	0	0
16	Do you face any difficulty due to having to speak to people from a distance (social distancing)?	155	77.5	45	22.5	0	0
17	Do you face any difficulty in speech comprehension due to muffled speech from wearing masks?	181	90.5	19	9.5	0	0
18	Do you feel any discomfort from wearing hearing aids for longer durations during the pandemic?	78	39.2	115	57.8	6	3
19	Do you feel any discomfort due to mask interfering with wearing hearing aids?	30	15	164	82	6	3
20	Do you face any difficulty due to the increase in the use of video calls during the pandemic?	5	2.5	3	31.5	132	66

DISCUSSION

The overall survey results revealed that although COVID-19 has negative impacts on all humans, this study was intended to learn how COVID-19 situations, including lockdowns, have affected individuals with hearing loss, and particularly hearing aid users. This survey study was administered by face-to-face interview, found that COVID-19 had an impact on audiological services required for hearing aid users. COVID-19 has also had an impact on their communication requirements. The main finding of the survey was that respondents indicated that COVID-19 had a substantial impact on them in a variety of ways. It is critical that they are aware of these consequences and have sufficient information to communicate with the rest of the world.

They reported that a lack of availability of speech and hearing clinics/Centers for access to audiological services, one significant discovery was that masks were interfering with communication. Face

Fig 1.2 Shows that 1.50% of the participants using hearing aids since less than 1year, whereas the 82% participants using hearing aids for 1-5 years, 11% participants using hearing aids for 6-10 years, whereas some participant using hearing aid since above 10 years 5.50%.

RESULTS:

Q. No	Question	Yes		Sometimes		No	
		Freq	%	Freq	%	Freq	%
1	Do you face any difficulty related to the availability of Hearing healthcare clinics/centres for hearing aid maintenance during the pandemic?	128	64%	21	10.5	51	25.5
2	Do you face any difficulty related to the availability of Hearing healthcare clinics/centres for acquiring new upgraded hearing aid devices	83	41.5	12	6	105	52.5
3	Do you face any difficulty related to the availability of hearing aid programming services during the pandemic?	121	60.5	33	16.5	46	23
4	Do you face any difficulty in reaching out to Audiologist or Hearing health care clinics to fixing hearing aid connectivity related problems (Bluetooth, TV, mobile phone related etc..,)?	34	17	3	1.5	163	81.5
5	Do you face any difficulty related to the availability of hearing aid batteries?	90	45	65	32.5	45	22.5
6	Do you face any difficulty related to the availability of hearing aid accessories like ear tips, wax guards etc..,?	83	41.5	43	21.5	74	37
7	Do you face any difficulty related to the availability of services for troubleshooting/repair of hearing aids?	109	54.5	40	20	51	25.5
8	Do you face any difficulty related to the availability of services related to ear moulds?	61	30.5	25	12.5	114	57
9	Do you face any difficulty related to the availability of teleaudiology services?	31	15.5	22	11	147	73.5
10	Do you face any difficulty related to the availability of a moisture drying kit for a hearing aid?	38	19	14	7	148	74

coverings are generally acknowledged to be an impediment to efficient speech communication. Face Masks have also been discovered to function as a low-pass audio filter interferes with communication. A study done by Hearing Loss Association of America (HLAA) in partnership with Cochlear Limited (Barbara Kelley, 2021) reported that 95% of the hearing loss community said that face masks, coverings have created communication barriers since the pandemic began (including speech reading, facial expression). Another study done by Naylor et al. (2020) reported that understanding people wearing face masks is harder because listeners can't see their mouth moving (80.7%). The current study results are also in congruence with most of the participants (99%) reported that they faced difficulties in reading facial expressions due to masks.

CONCLUSION

COVID-19 has proven to be pandemic and affecting the day-to-day life of normal individuals. However, individuals with disability, especially with hearing aids users face even more difficulty. They are unable to get their routine evaluation and hearing aid maintenance. masks and social distance were interfering with communication.

ACKNOWLEDGEMENT

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EARLY IDENTIFICATION AND DETECTION OF MINIMAL & MILD HEARING LOSS DUE TO COVID-19 PRECAUTIONS

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INTRODUCTION:

In the current pandemic of coronavirus (COVID-19), health and government officials are encouraging, even mandating, community-wide face mask wearing and social distancing to reduce the spread of coronavirus. There are three major categories of masks being used to limit the airborne transmission of large respiratory droplets and infectious agents: a respirator, or filtering face piece (FFP), such as an N95 mask; medical face masks, such as a surgical or procedure mask; and nonmedical masks, such as commercially or self-made masks usually made of cloth or other textiles. Based on mechanistic plausibility and the desire to reduce SARS-CoV-2 transmission and community impact, universal masking and social distancingare recommended as a means of source control of both symptomatic and asymptomatic individuals to prevent the spread of infectious respiratory droplets to others().

Minimal hearing loss ranges from 16 dB to 25 dB and Mild hearing loss can be defined broadly to include a three-frequency pure-tone average (PTA; 0.5, 1.0, and 2.0 kHz) threshold ≥ 25 and ≤ 40 dB HL.() In Minimal &Mild hearing loss, one-on-one conversations are fine but the client having difficulty understanding some words when there's a lot of background noise, the client may have mild hearing loss. Mild hearing loss is one of thefactor that can negatively affect speech intelligibility. This may be the consequence of missing speechcues due to reduced audibility or of distortions due tosupra-threshold factors related to hearing impairment ().Minimal &Mild hearing loss might not have a problem in a fast-speech environment, but could have considerable difficulty in a noisy one().

Persons with hearing loss uses phonemic restoration effect as a top-down approach to compensate for missed phonemes or missed words in a sentence. Phonemic restoration effect is a perceptual phenomenon where under certain conditions, sounds actually missing from a speech signal can be restored by the brain and may appear to be heard i.e., the brain tends to fillthe absent phonemes.Minimal &Mild hearing loss individuals could benefit from phonemic restoration, moderately HI individuals could not (). This observation implies that in minimal&mild hearing impairment, top-down mechanisms can still be effectively used. However, as the degree of hearing impairment increases, these mechanisms seem to lose their effect.

The distorted speech sometimes remains intelligible due to the acoustic and linguistic redundancy in speech signals, where speech cues are coded in multiple ways, and the rich sentential context, which provides additional information for resolving lexical ambiguity (). Hence, speech with missing segments can be perceptually restored using the acoustic and linguistic content of the audible speech segments, either locally or globally, using context (). The top-down restoration can be so strong that, under specific circumstances, listeners may not even be aware of the missing part of a speech signal.Lip-reading can also play an important role in helping to alleviate the majority of moderate to severe impairments acquired post-lingually. Its success in this role depends upon the ability of perceivers to relate what they see to what they hear. This is where the analysis must start. When perceiving speech audio-visually observers select place information from vision; manner and voicing information from audition().

During COVID-19 pandemic time, peoples are using mask and following social distancing. As a result, the speech cues that are necessary to trigger the compensatory cognitive mechanisms are not adequately transmitted.

METHODOLOGY:

A total of 30 participants aged 35-55 years (mean age, 41 ± 2.6 years) were involved in the present study who met the inclusion criteria. Participants with minimal or mild hearing loss in atleast one ear and no normal hearing in other ear were included in the study. They were asked to fill the questionnaire, which is divided into two sets of questions based on two different situations. Situation I contain 10 questions related to communication difficulties during interaction with people who follows social distancing and use face mask. Situation II contains 10 questions related to communication difficulties during interaction with people who do not follows social distancing and do not use face mask.

Based on the communication difficulty, the participants were requested to rate the questions in a four point rating scale i.e., “always”, “mostly”, “rarely” & “never”. Where “always” is the response for maximum communication difficulty and “never” is the response for no communication difficulty. The response “always” and “mostly” is the indication of communication difficulty; the response “rarely” and “never” is the indication ofless/no communication difficulty. The responses were analyzed using Analysis of variance (ANOVA) test forcommunication difficulties between the two situations and also for the comparison of responses within situation.

RESULT:

Responses of participants were compared for situation I and II. The number of responses i.e., “always”, “mostly”, “rarely” & “never” was counted individually. For situation I, the responses are 24.3 %, 49 %, 23.7% and 3% for always, mostly, rarely and never respectively. For situation II, the responses are 7%, 17.7%, 47.6% and 34% for always, mostly, rarely and never respectively. The combined response (always + mostly) for situation I (M = 3.67, SD = 1.8) was compared to the situation II (M = 0.91, SD = 1.49) using independent sample t-test.The response for communication difficulties was significantly high in situation I, $t(118) = 9.06, p = .00.$ Bar graph of responses obtained for situation I and situation II questionnaire are displayed in Figs. 1 and 2 respectively. Figure 3 displays bar graph of combined response (always+mostly) for situation I & II.

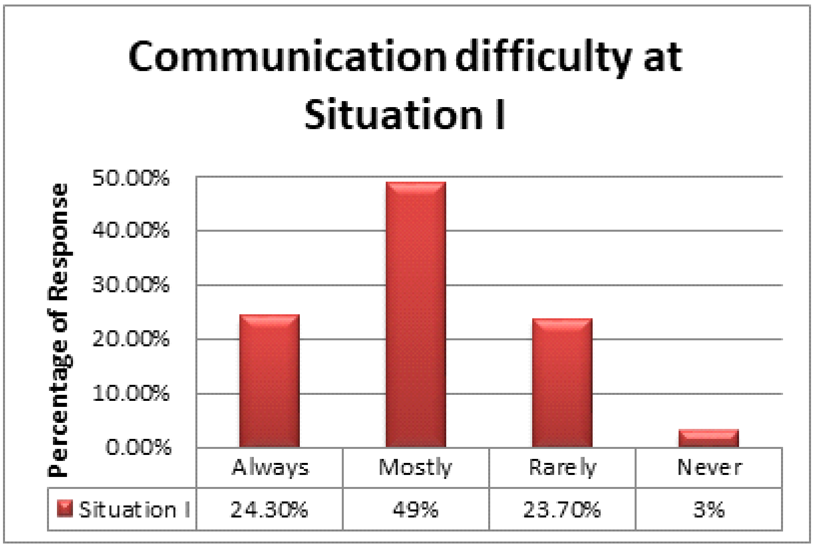

Figure 1: *Showing responses of situation 1 questionnaire*

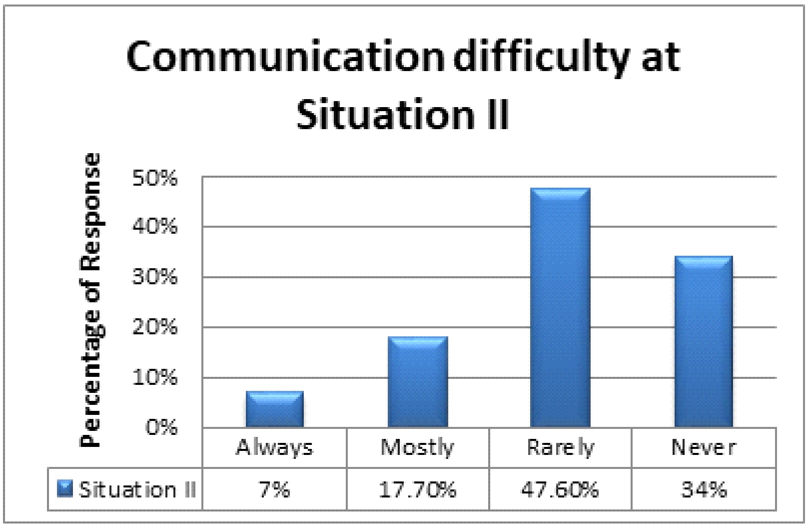

Figure 2: *Showing responses of situation 2 questionnaire*

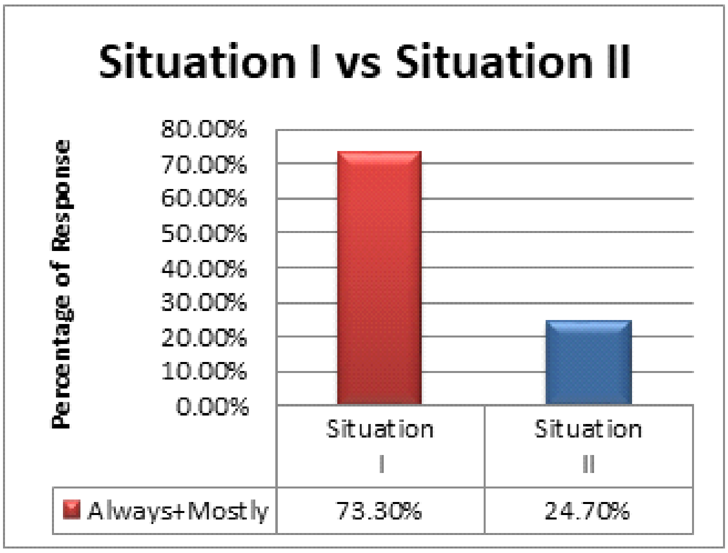

Figure 3: *Showing comparison of communication difficulty at situation I and II.*

DISCUSSION:

In the present study, the communication difficulties across two different situations were compared using questionnaire method and it was observed that communication difficulties were significantly high in situation I.These findings suggest the hypothesis of the study that the impact of social distancing and face mask increased the communication difficulties and self-realization of minimal or mild hearing loss. This is due to the degradation of speech cues due to face masking and social distancing.

More communication difficulty at situation I indicates that the clients with minimal &mild hearing loss are facing more difficulties to understand the speech of other person. The clients with minimal &mild hearing loss use their cognition and other facial cues to fill up the missed syllables in the word and understand the sentence. But use of face mask degrades speech quality and denies important visual clues (example, lip reading, facial expressions), and a loss of 3-4dB in intensity has been viewed in medical mask and nearly 12 dB loss for N95 mask().Conversational distances between two talkers ranges from 1.5 to 3 feet**,** and for maintaining social distancing, the recommended distance is atleast 6 feet (which translates to a doubling or even quadrupling of the distance) so according to inverse square law, the sound pressure level decreases by 6 to 12 dB(). This reduction in intensity and unavailability of important facial cues further increase the problem of clients with mild hearing loss to understand the speech.

This study examined thecommunication difficulties of patients with minimal &mild hearing loss in various situations. It is observed that the communication difficulty increases as people around them follows COVID 19 safety protocols i.e., face mask and a social distancing of atleast 6 feet.

SUMMARY &CONCLUSION:

In current situation of COVID-19 pandemic, people use face-masks and follow social distancing, which in turn decreases external cues to understand the message. This will hamper phonemic restoration ability (top-down approach) of clients with minimal & mild hearing loss. This reduced top down approach will make them understand about their hearing loss. We remain hopeful that, with increased realization of minimal &mild hearing loss in clients motivates them to visit audiology clinic and helps the hearing health care professionals to provide better interventions like early identification and early treatment options to them. This early identification and early intervention help the clients with minimal &mild hearing loss to listen clearly even in the situations where people use face mask and follow social distancing.

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AWARENESS ABOUT THE IMPACT OF NOISY LEISURE ACTIVITIES ON HEARING HEALTH IN INDIA: A SURVEY STUDY

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INTRODUCTION:

Hearing loss is estimated to be the fourth leading cause of disability globally (WHO GHE, 2015) and second leading cause of disability nationally(Cunningham & Tucci, 2017). WHO estimates in 2018 found that over 466 million peoplesuffer from a disabling hearing loss. WHO estimates of 2005 put a figure of 278 million on people who have disabling hearing impairment in India.The two most common causes of hearing loss in adults are generally accepted as, the effects of ageingand noise induced hearing loss (NIHL).According to the WHO in 2005, occupational noise exposure is responsible for 16% of hearing loss in adults. (Nelson, Nelson, Concha-Barrientos, & Fingerhut, 2005). NIHLis one of the most frequent problems among teenagers, and it has been called the "silent pandemic" since it often goes unnoticed in the non-occupational setting(Martin, Sobel, Griest, Howarth, & Yongbing, 2006).In the last two decades, NIHL has become a global problem, due to the increased usage of smartphones (Sliwinska-Kowalska & Davis, 2012). Furthermore, as the number of smartphone users expanded, so did the use of personal listening devices (PLDs), such as earphones and headphones(Danhauer et al., 2009).NIHL is a sensor neural hearing loss that starts at higher frequencies (3,000 to 6,000 Hz) and gradually worsens as a result of long-term exposure to loud noise(Rabinowitz, 2000). The equivalent sound levels ranged between 75 and 105 dBA from personal music players (Serra et al., 2005).This effect of excessive noise exposure is governed by certain factors which include the Noise level, duration of exposure, frequency of sound, individual susceptibility and vulnerability due to environmental and biological factors. Long-term high-intensity noise exposure is linked to damage in the inner ear's sensory hair cells, establishment of a permanent hearing threshold shift and poor speech in noise intelligibility. There is also evidence that noise exposure causes tinnitus, which could be caused by changes in central auditory function (Henderson, Bielefeld, Lobarinas, & Tanaka, 2011).

Need:

Apart from noise at work, imprints of noisy leisure activities on the world of noise induced hearing loss are pervasive. In 2015, the WHO warned that 1.1 billion young people (or about 50%) were at risk of hearing loss due to personal listening devices and loud music venues where sounds may reach 120 dB for hours on end (80 dB and lower is considered safe by NIOSH). Even though these music settings may be jarring, many music listeners and musicians do not use hearing protection (Olson, Gooding, Shikoh,

& Graf, 2016)(Verbeek, Kateman, Morata, Dreschler, & Mischke, 2014).

Many are unaware of the risks associated with prolonged exposure to loud music.Music lovers are enthralled by the introduction of the ear-buds that are used with smart phones, iPods and MP3 players. While research suggests that personal listening devices may not be as great a concern for an adult-professional population, routine, long-term use levels are not clearly documented among younger listeners (Hodgetts, Rieger, & Szarko, 2007). In India, NIHL being compensable bears a little awarenessamong workers but there's paucity of data regarding the impact of leisure noise activities on hearing health. The current study aims to fill this literature gap andhighlight some of the

Aim and Objective:

The aim of the study is to identify symptoms of loud sound exposure on hearing health and to highlight the roles of hearing healthcare professionals in identification, management and prevention of hearing loss and to compare and contrast the results across the age, gender and occupation.

METHODOLOGY:

A total of 400 participants participated in the study. The participants were categorized based on age, gender and occupation. The age group was further divided into younger (<21 years) and elder group (21+ years); Gender into male and female; Occupation into professional and students respectively. The participants were requested to fill the questionnaire. The questionnaire was validated by five audiologists. This survey was done via Google form. Pearson chi-square test of independence was administered to compare the responses of each parameter between younger and elder group; male and female; professional and students.

RESULTS AND DISCUSSION:

In view of first objective it was observed that the younger age group(75.2%) and students (69%)showed better awareness of hearing healthcompared to the elder age group(60.7%) and the professionals (57.4%). This awareness can be attributed to better media exposure and improved sense of fitness in younger generation and students.

Further investigation was carried out to check the duration of use of personal music devices for over 6 hours a day. It was observed that the younger age group (15.7%)and the student (14.1%) category had longer exposure the elder age group(11.3%) and the professionals' category (9.6%). It was also observed that professionals(34%) and elders (12%) do not use any personal music devices.This is because younger generation are more interested for music listening.The volume preference was also investigated across the groups. The preferred volume level for listening to music was reported to be medium by a nearly equal proportion of elder, professional, younger, and student categories. A relatively surprising 16.3% of younger categoryreported listening to low volume levels of music than the elder category(7.3%).

Among students 12.1% reported listening to the music at high levels as compared with only 6.4% professionals who reported the same level. Despite stating “medium level” of volume, a huge variability exists in loudness level which can cause undesired impact on hearing thresholds.According to a survey conducted by Rawool, V. W. and L. A. Colligon-Wayne in 2008, 50% of students are exposed to potentially harmful loud music, despite the fact that 75% of students appeared to be aware that loud music could cause hearing loss (Rawool & Colligon-Wayne, 2008).According to Torre III, P. in 2008, over 50% Young adults reported music listening between 1 and 3 hours and almost 90% reported listening at either a medium or loud volume. Men were significantly more likely to report listening to their system for a longer duration compared with women and more likely to report listening at a very loud volume (Torre III, 2008).

The symptoms of loud sound exposure were studied extensively. These symptoms included tinnitus, reduced hearing and ear pain.Tinnitus was reported to be observed mostly among females (23%) than males (11.4%); elders (17%) than younger (14%) age group. Reduced hearing immediately after loud sound exposure was reported mostly by Elder (12%) than younger (5%) age group and can be attributed to the synergistic effect of aging and noise exposure. Ear pain following loud sound exposure was reported mostly by younger (16%) than the elder (10%) age group.One major reason could be that the younger group mostly uses insert earphoneswith their personal devices. Their improved sound quality and stereo effect encourages them to wear them for hours at end causing discomfort and TTS due to increased sound output. According to a survey done by Holmes et al. on 245 participants of age group 18-27 years and it was found that over 20% of participants reported ear pain, tinnitus, and/or Temporary Threshold Shift (TTS) after noise exposure sometimes (Holmes, Widén, Erlandsson, Carver, & White, 2007).

Professionals (54.3%) as well as students (45.1%) were aware of the hearing healthcare professionals and their role and involvement in providing hearing related solutions. Based on these findings it can be concluded that there is a consensus among these groups regarding the fact that trained hearing healthcare workers should be at the forefront in order to bring awareness about care, cure and maintenance ofhearing health.According to the survey done in rural areas of Limpopo province of South Africa, just 14% of respondents were aware of the audiology profession, demonstrating that people in rural areas are unaware of the function of audiologists and the services they provide.(Joubert, Sebothoma, & Kgare, 2017). Another survey of college students done by Lass et al in 1989 stated that 91.3% of the respondents knew about hearing protective devices that are used in factories or other noisy environments, to help to prevent hearing loss (Lass, Woodford, & Everly-Myers, 1989).

SUMMARY & CONCLUSION:

The younger age group is more aware of hearing health compared to the elder age group. The younger age group had longer exposure then the elder age group. Younger generation are more interested to listen music. Students reported to be listening the music at high levels as compared to the professionals. Tinnitus was reported to be observed mostly among females than males. Reduced hearing immediately after loud sound exposure was reported mostly by elder group than younger age group. Ear pain following loud sound exposure was reported mostly by younger than the elder age group. Almost equal percentage of professionals and students were aware of the hearing healthcare professionals and their role and involvement in providing hearing related solutions.

There is a gaping void between the general awareness and the knowledge of the consequences of a hearing loss among the participants of the study. A nationally representative sample like this warrants an immediate action by the relevant professionals and authorities to address this gap. Hearing Health Promotion Programs are recommended for this population.

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IMPACT OF HEAVY WEIGHT LIFTING ON VARIOUS ATTRIBUTES OF EAR

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INTRODUCTION:

Exercises such as squats and dead-lifts, are elemental full body exercises. The squat is a well–known exercise to strengthen the muscles of the lower limb. The squat is a closed–chain movement, requiring simultaneous extension patterns of the ankle, knee and hip joints. The deadlift is a simple and functional exercise that requires force application and transfer through the entire kinetic chain. Deadlift involves the simultaneous activation of multiple muscle groups throughout the entire body; this coordinated effort results in a significant amount of stress on the musculoskeletal system including ears. The Deadlift involves many of the large muscle groups in both lower and upper body. The deadlift is commonly performed by power lifters and weightlifters (Farley, 1995). It is observed that people holds their breath while lifting to get extra strength. Breath control significantly increases intra-abdominal pressure and helps to stabilize the spine while performing the exercises(Hagins, Pietrek, Sheikhzadeh, & Nordin, 2006)Intra-abdominal pressure has been shown to increase consistently during static and dynamic lifting tasks(Hagins, Pietrek, Sheikhzadeh, Nordin, & Axen, 2004). During weight lifting, the tendency of breath holding increases as the participant lifts heavier weight. However, holding the breath during weight lifting can lead to menacing increase in blood pressure, which can lead to injury to internal organs.

Need:

This research was executed to examine the effect of weight lifting on various attributes of ear. In this study we determined the damage on hearing functioning because of heavy weight lifting. The outcome of the study will be used to create the awareness about the negative impact of holding breath during heavy weight lifting task.

Aim & Objective:

The primary aim of the study was to investigate the impact of heavy weightlifting on various parameters related to ears like blocking sensation, tinnitus, vertigo, headache and temporary threshold shift on light weight lifters (LWL) and heavy weight lifters (HWL).

METHODOLOGY:

A total of 40 participants aged 18 to 30 years were involved. The participants who use any types of steroid were excluded from the study. Participants include 20 LWL and 20 HWL. LWL includes participants who lift half or less than half the body weight. HWL includes participants who lift more than the body weight. They were requested to fill the self-administered questionnaire, which contain questions related to various parameters related to ears like blocking sensation, tinnitus, vertigo, temporary threshold shift and headache. Each question consists of two responses i.e., “yes” &“no”. The participants were requested to fill all the questions of the questionnaire.The questionnaire was validated by ten audiologists.This survey was done via Google form and direct face to face interview method.Shapiro-Wilk test was administered and it was observed that the responses for all the parameters were normally distributed.Pearson chi-square test of independence was administered to compare the responses of each parameter between LWL and HWL.

RESULTS & DISCUSSION:

The results revealed that,there is a significant difference between HWL and LWL for blocking sensation, tinnitus, vertigo and headache.HWL are more likely to have blocking sensation than LWL, X2 (1, 40) = 6.46, p = .011. HWL are more likely to have tinnitus than LWL, X2 (1, 40) = 4.912, p = .027. HWL are more likely to have vertigo than LWL, X2 (1, 40) = 5.013, p = .025. HWL are more likely to have headache than LWL, X2 (1, 40) = 8.286, p = .004. No significant difference between HWL and LWL for temporary threshold shift, X2 (1, 40) = 2.506, p = .113 was noted. It was also noted that 65 % from HWL and 25 % from LWL experienced blocking sensation. 70 % from HWL and 35 % from LWL experienced tinnitus. 75 % from HWL and 40 % from LWL experienced vertigo. 80 % from HWL and 35 % from LWL experienced headache. 60 % from HWL and 35 % from LWL experienced temporary threshold shift.

These findings suggest the hypothesis of the study that holding the breath during heavy weight lifting creates the negative impact on ears. The parameters like blocking sensation, tinnitus, vertigo, headache and temporary threshold shift was observed more in HWL as compared to LWL, as HWLs hold their breath during lifting task. Breathing ensures that the blood circulating to working muscles is oxygenated and that waste products are removed. Holding the breath during weight lifting can lead to increases in blood pressure, which can lead to internal injury.High blood pressure can affect blood vessels throughout body, including ears. Arterial hypertension occurring during heavy exercises may be a risk factor for stroke in healthy young adults (Narloch & Brandstater, 1995).

Individuals engaging in weight training may be dangerously increasing their BP during exercise. With the load of weight, one will use a Valsalva technique resulting in an increase in intrathecal pressure raising BP to extreme levels (Lepley & Hatzel, 2010).Research has linked increased rates of hearing loss in individuals with hypertension(Hansen, 1968), (Agarwal, Mishra, Jagade, Kasbekar, & Nagle, 2013), (Nawaz et al., 2021).Holding breath during exercise has a negative impact on overall health including ears. A brief Valsalva maneuver, which exaggerates the increase in blood pressure, is unavoidable when desired force production exceeds approximately 80% maximum voluntary contraction(MacDougall et al., 1992).Because of this Valsalva maneuver, the positive pressure shifted to middle ear via Eustachian tube, which leads to a sensation of blocking in the ear, tinnitus and temporary threshold shift.

Researchers reported the incidence of sport-related headache to be around 35%. Individuals participating in weight training were the second most common group of headache sufferers behind runners (Williams & Nukada, 1994). Sport-related headaches have been reported in relation to many activities, including weight lifting (Powell, 1982). In weight lifting, the brief intense activity is believed to trigger specific headache types. During heavy weight lifting, holding a breath increases blood pressure, which may result in tinnitus, vertigo, headache, and temporary or permanent threshold shift.

SUMMARY & CONCLUSION:

Strenuous exercises like heavy weight lifting can lead to variousear problems such as blocking sensation, temporary threshold shift, tinnitus, and vertigo. This might lead to permanent hearing loss. Good breathing technique can help you control feelings of lightheadedness. If you lift heavy weights that cause you to strain, force yourself to breathe uninterruptedly throughout the movement. Exhale through to the top of the movement, and then inhale as you return to the starting position. Holding your breath while lifting weights is not recommended, due to the strain it places on the heart and the spike it causes in blood pressure. Exercises which do not require breath holding will be a better option. Hence, one should do exercises that are ear friendly by keeping these health parameters in mind. One should not ignore any symptoms like blocking sensation, tinnitus, vertigo, headache, temporary threshold shift, and go for hearing evaluation promptly if experiencing any change in these parameters during or after a workout. Remember to reduce the amount of weight in lifting exercise to prevent excessive straining.

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SPATIAL HEARING ABILITIES IN MODERATE CONDUCTIVE AND MODERATE SENSORINEURAL HEARING LOSS- A COMPARITIVE STUDY

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INTRODUCTION

In everyday life, hearing is a crucial factor to detect and process the sounds from environment.To locate the sounds coming from the environment the aspect called spatial hearing is required; it is based on the comparison of acoustic information perceived by both the ears. Spatial hearing is one of the incredible abilities of auditory system. It is associated with binaural hearing and auditory localization to infer or make use ofdiverse spatial paths through which sounds reach the head.

By means of spatial hearing, the auditory system can locate the sound source and 'unmask' sounds obscured by noise. It can also help to attend towards or away from a sound source. Spatial hearing is completely based on 'binaural' hearing: the comparison of signalfrom one ear toanother ear. (Abdollahi,2018).

The incapability to differentiate spatial cues is recognized as spatial hearing loss. For example, if a person suffers from spatial loss, they are unable to tell where a sound came from. They have difficulty in picking one person's voice out of a crowd. People with this situation find it difficult to disablebackground sounds in noisy environments. The ear is not the foundation for spatial hearing loss. Instead, it is thought to occur within the brain pathways that interpret noise.Spatial hearing may be affected due to hearingimpairment.

There are two questionnaires that assess spatial hearing and its related disability. The Spatial Hearing Questionnaire (SHQ) and Speech, Spatial and Qualities of Hearing Scale (SSQ).Spatial Hearing Questionnaire (SHQ) focuses only on speech perception in quiet conditions, spatial hearing situations as well as localization of a sound source. It attempts to separate spatial hearing performance with stimuli of different frequency (e.g., male voices vs. children's voices). SHQ has 24 questions.

Cameron, Glyde, and Dillon (2011) studied spatial processing in normally hearing adolescents and adults aged 12 to 60 years and, among the adults usingLiSN-S and revealed no effect of age on spatial processing ability.

Tyler, Perreau,Ji, 2009 compared the performance of individuals with normal hearing cochlear implant (CI) users using the Spatial Hearing Questionnaire (SHQ). Significant difference was observed among the groups, the pattern of responses was similar, revealing similar challenges in a variety of listening situations.Noble and Ter-Horst (1997) documented deficits in auditory localization, detection, spatial ability, and speech hearing in noise in individuals with sensorineural hearing loss conductive hearing loss& mixed hearing loss. Lengshi Dai,Virginia Best 2018 and W Noble et al reported that spatial hearing is affected in elderly patients with sensorineural hearing loss and conductive hearing loss.

NEED FOR THE STUDY

A few studies on spatial hearing reviewed its ability via some standard tests such as LISN-S test and SSQ hearing scale test. It is crucial for clinicians to learn whether moderate hearing loss could affect the spatial ability in adults. This study would fill up this void.

Aim

The study aimed to examine spatial hearing abilities in subjects with moderate conductive and moderate sensorineural hearing loss using spatial hearing questionnaire (SHQ).

METHODOLOGY

Forty-five participants were recruited for the study. They were categorized into fifteenmoderate conductive hearing loss, fifteenmoderate sensorineural hearing loss and fifteen normal hearing individuals. Age range of the subjects was 30 to 60 yearswho were recruited from privateclinics. Otoscopy was done forall participants to rule out presence of any anomaly of ear canal, tympanic membrane perforation or any other foreign body in the earcanal. Pure tone audiometry and Speech audiometry was performed using a Labat - Audio lab+ clinical audiometer. Immittance audiometry was performed with Ocilla T840 to evaluate the middle ear function.

Individuals with moderate conductive and moderate sensorineural hearing loss were administered Spatial hearing questionnaire (SHQ). It assesses the perception of male and female voices, music listening,sound localization,speech perception in quiet and noise with target and noise sources from the front and speech perception in noise with target and noise sources spatiallyseparate.

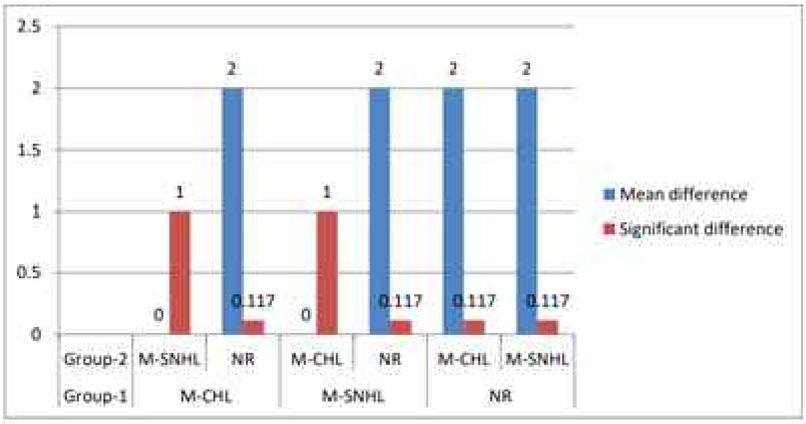
The self-rated questionnaire was administered on three groups.Informed consent was obtained before administration.Each answer that is marked 'Difficult' were given a score of '0', answers marked 'Easy' were given a score of '1'.

Data was analyzed using SPSS software version21.0. T-test was done to find out statistical significance among groups and Post hoc test and ANOVA was used for multiple comparisons between three groups.

RESULTS & DISCUSSION

Spatial hearing abilities were assessed in three different groups namely: normal hearing, moderate conductive hearing loss and moderate sensorineural hearing loss.There was no significant difference in mean scores of Spatial hearing questionnaire among the three groups. Results are in accordance with the study conducted by Cameron, Glyde, and

Dillon; 2011.



(Bar diagram shows the mean diff and significant diff between and within the three groups.)

Slight difference was seen in mean value for M-SNHL and M-CHL in comparison with normal hearing individuals. Scores of t-test revealed no significant difference. There were same findings in the study done by Tyler and Perreau Ji; 2009.

Scores were compared for moderate conductive hearing loss and moderate sensorineural hearing loss. Findings state that scores are similar for both groups with hearing loss. There was no significant difference observed for conductive hearing loss and sensorineural hearing loss.

Results are in contradiction with the study of Maryam Delphi et., al (2019), which showed significant positive correlation between the scores of spatial word-in-noise test and spatial hearing questionnaire in three groups i.e, mild, moderate and normal hearing and hearing loss can deteriorate spatial hearing ability. There was no difference in subscales for spatial hearing in mild and moderate hearing loss (Maryam 2019).Slightly higher scores on SHQ were obtained in normal hearing, and lower scores were seen in moderate hearing loss. Greater the hearing loss more is the difficulty people experience in spatial hearing. This finding is in line with the study conducted by Nader Saki et al. 2015. The results showed that the SHQ is an appropriate instrument to detect function difference attributed to the degree of hearing loss. It also conveyedthat,if there is greater hearing threshold loss, the more difficulties people experience in spatial hearing.

CONCLUSION

Spatial hearing is one of the most important auditory processing that affects speech understanding in noise. There is an unconditionalrequirement for suitable tests for its evaluation. It is strongly recommended that audiologistsuse valuable screening tool such as spatial hearing questionnaires (SHQ) clinically to examine the extent of spatial hearing disorder majorly prone to subjects who are above moderate degree of hearing loss. Moreover, SHQ can be completed independently by most patients in few minutes, it can be added in protocol for hearing screening which help's audiologists to have quick review on spatial ability in hearing loss.. patient's and to use it in rehabilitation.

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THEORY OF MIND IN HEARING IMPAIRED

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Key words: *Theory of mind, Hearing impaired, language development*

INTRODUCTION

The ability of humans to perceive circumstances, events, and emotions, as well as the understanding of how to govern human behaviour as guided by mental states such as thoughts, knowledge, wants, feelings, and beliefs, is referred to as theory of mind (ToM). The primary idea behind the development of ToM is that youngsters at 4 years of age obtain an awareness of the condition of events and the minds of others. Literature review states that there were observable delays in theory of mind in hearing impaired individuals. These delays would lead to an impact on social communication both directly and indirectly.

Development of TOM is closely intertwined with language development in humans. Both language and TOM seem to begin to develop substantially around the same time in children(between ages 2-5). With the development of language, there is development in TOM. TOM is an important aspect of pragmatics of language. Presence of TOM facilitates better human communication by allowing one to predict, understand and explain other person's behaviour. Thus an absence of TOM can lead to communication breakdown. Around age 4, children improve on tasks of theory of mind and are able to understand that someone may be acting based on a false belief about an object or event (Kloo et al;2010).

The time taken to obtain the capacity of ToM is longer for children with hearing loss than in children with normal hearing. It is considered that hearing loss, independent of language development in early children may impede the development of ToM. ToM development has also been researched in children with hearing loss. Peterson and Siegal (1995) gave a "change in location"-type false belief test to 26 Australian children with severe and profound HL ranging in age from 8 to 13 years (mean age: 10 years), and reported a pass rate of only 17%. Steeds et al. (1997) reported a 70% pass rate for a "change in location"-type false belief test for 22 children with profound hearing loss aged 5 to 12 years in England, which was better than Peterson and Siegal's study. Although, the scores are lower than predicted for their chronological ages.

ToM in children with hearing loss has also been researched in terms of language development. Jackson (2001) reported on the association between ToM and receptive language ability in children with severe to profound hearing loss, pointing out that when age was excluded, no relationship was detected in native signers. They employed false belief tasks such as "change in location" and "unexpected contents," as well as a false photograph test.Schick et al. (2007) studied 176 children with hearing loss aged 4-7 years (mean age: 6 years) and discovered that receptive vocabulary and syntactic complement processing abilities were significant predictors of passing the "change in location"-type false belief test.

Need for the study:

To understand the development of theory of mind in hearing impaired individuals as well as issues faced by them.

Aim:

The study aims to explore the theory of mind in hearing impaired individuals

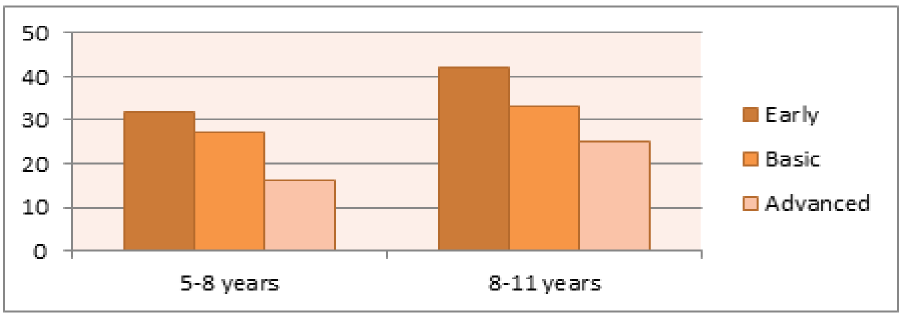
METHODOLOGY:

60 hearing impaired children participated in the study between the age range of 5-11 years. Participants were categorized into two groups: Group1:5-8 years and Group 2:8-11 years. Each group had 30 participants with equal number of boys and girls. All the children were diagnosed as profound sensorineural hearing loss. For this study, theory of mind inventory-TOMI (Hutchins et al; 2014) questionnaire was administered to the caregiver of the participant. It consists of 42 items designed to tap a wide range of social cognitive understandings. TOMI has 3 factors: early subscale, basic subscale and advanced subscale. Each item takes the form of a statement and is accompanied by a 20-unit continuum anchored by 'definitely not', 'probably not', 'undecided', 'probably' and 'definitely'. The respondent is asked to read a statement and draw a hash mark at the appropriate point along the continuum.

Informed consent was obtained from caregiver prior to the collection of data. Caregiver should spend atleast 5 hours a day with the child in order to participate in the study. Scoring of the questions is done using the ruler that accompanies the questionnaire. Score of 0-20 is given for each question. Data was analyzed using SPSS software version 21.0. T-test was done to find out significance among groups and gender.

RESULTS & DISCUSSION :

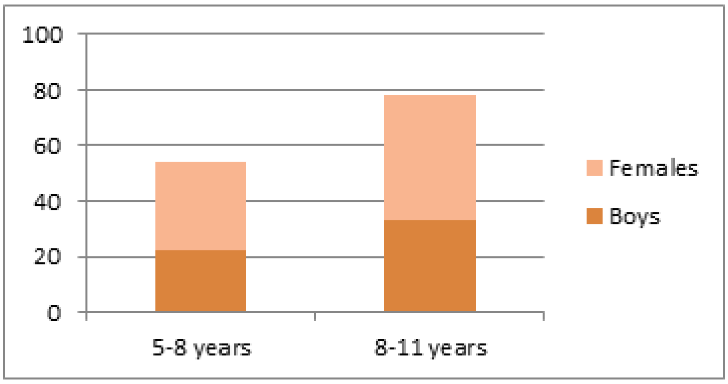
Older group had better scores compared to younger groups. Girls performed better than boys. When score were computed it was noticed that theory of mind was delayed and they were not age appropriate. Most of the participants had high pass rate on early subscale of theory of mind inventory. Order of responses were higher in early, basic and lastly the advanced subscale. As deaf children lack in conversations, they are at a high risk of missing information about the world. But most of the deaf children try to communicate and they are socially competent. Although their language development is delayed, they use visual mode for conversations. Most of the deaf individuals in the world communicate through sign language.



(Graph 1: Performance of both the age groups on subscales of TOMI)

From the above graph, it can be depicted that early subscale was better in both the age groups compared to basic and advanced subscales. Significant difference was observed in both the age groups for early and advanced subscales. Higher performance was noticed in older age group. Children in group B have better language skills. Hence theory of mind was better in this group. So, language development has direct relationship with theory of mind. Greater the language skills, higher is the theory of mind in the individuals.(Schick et al. (2007))

The relationship between language and ToM abilities appears complicated in deaf and hard of hearing (DHH) youngsters. For example, "mental state verbs" and "if/then phrases" are used in false-belief tasks. Understanding such complicated ToM activities requires a certain degree of language and communication abilities.



(Graph 2: Performance of both gender on TOMI inventory)

Graph 2 describes gender variation performance on TOMI inventory. Significant difference was observed in gender. Girls outnumbered boys. Performance was higher for all the subscales in girls. Literature states that girls acquire language faster than boys. At the age of 10 and 24 months, girls are in advance than boys when they use gestures. Usage of words and combining words to form phrases and sentences is sooner than boys. Gap between girls and boys grows from age one to two years but may not last. This gap starts to decrease once they reach the age of 3- 6 years. Vocabulary development, usage of different forms of sentences and social skills are greater in girls. As a result, girls are able to understand and perceive different circumstances, events, wants, beliefs, feelings and emotions.

Findings are in accordance with study done by Peterson and Siegal (1995) who gave a "change in location"-type false belief test to 26 Australian children with severe and profound HL ranging in age from 8 to 13 years (mean age: 10 years), and reported a pass rate of only 17%. Steeds et al. (1997) reported a 70% pass rate for a "change in location"-type false belief test for 22 children with profound hearing loss aged 5 to 12 years in England, which was better than Peterson and Siegal's study. Although, the scores are lower than predicted for their chronological ages.

CONCLUSION

The relationship between language and ToM abilities appears complicated in deaf and hard of hearing (DHH) youngsters. For example, "mental state verbs" and "if/then phrases" are used in false-belief tasks. Understanding such complicated ToM activities requires a certain degree of language and communication abilities.

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AUDIOLOGICAL FINDINGS OF STREPTOMYCIN INDUCED COCHLEOTOXICITY- A CASE REPORT

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ABSTRACT

Background: *Cochleotoxicity is a drug induced ototoxic condition in which individuals will take medications receiving medications for serious health issues. Amino glycosides are one such prophylaxis prescribed for various bacterial infections like tuberculosis, respiratory illness, sepsis, endocarditic etc which has an ototoxic effect on individuals hearing. Streptomycin is a first amino glycosides discovered and prepared from Streptomycin griseous commonly used to treat tuberculosis. Some of the researchers have reported the Cochleotoxicity and vestibulotoxic effect of Streptomycin on inner ear but still there is a dearth in research evidences. Hence the present case report aims to highlight the clinical findings in a case presented with Ototoxicity induced by streptomycin.*

Case description: *A client of 67 year old male came to the department with the complaint of ringing sensation in both ears more in left side since 10 years. Detailed history revealed that the client was diagnosed with Acid-Fast Bacillus (AFB) tuberculosis and taken 51 dosage of streptomycin. The client reported that post medication started exhibiting reduced hearing ability and tinnitus with no vestibular symptoms. The detailed audiological evaluation was carried out by administering Otoscope examination, pure tone audiometry, speech audiometry, impedance audiometry, Reflexometry, Oto acoustic emission and tinnitus evaluation. On observation tympanic membrane is visible with absence cone of light in both ears. The pure tone audiometry thresholds in routine audiological evaluation revealed mild sloping sensorineural hearing loss in left ear and minimal High frequency sloping hearing loss in right ear with good speech identification scores. Immitance evaluation indicated no middle ear pathology with normal reflexes. Absence of distortion product oto acoustic emissions in both ears. Tinnitus was matched at the intensity level of 25decibel with frequency of 2 KHz in right ear and 60decibel with 3 KHz frequency in left ear respectively with positive residual inhibition upon tinnitus masking in both ears.*

Conclusion: *The observations and findings in the present condition indicates that the impact of streptomycin on hearing apparatus and suggest tinnitus as a predominant consequence than hearing loss and highlights that ototoxic drug streptomycin produce tinnitus. It is likely that there will be a late onset of hearing loss due to persistence of the drug in the cochlear fluids or may be progressive in nature even after stopping the medications. Thus the present study emphasizes the need of frequent monitoring of hearing in these individuals even after the withdrawal of medications to ensure better quality of life.*

Keywords: *streptomycin, Cochleotoxicity, Ototoxicity, Cochleotoxicity hearing loss*

INTRODUCTION

Hearing loss can be a significant handicap in an individual's life. The majority of hearing-impaired people live in underdeveloped nations due to various etiologies. Medications are one such cause for hearing loss which can be considered as Ototoxicity causing damage to cochlea and vestibular apparatus of inner ear. Ototoxicity is an irreversible side effect of amino glycosides [1]and could manifest as either cochlea damage with permanent hearing loss or vestibular damage with dizziness, ataxia and/or nystagmus [2]. The ototoxic effect is dose-dependent [1] and compounded by the narrow therapeutic range of amino glycosides and the wide inter-individual variability in the pharmacokinetics of the drug[2].

Amino glycosides are one such prophylaxis prescribed for various bacterial infections like tuberculosis, respiratory illness, sepsis, endocarditic conditions etc. which has an ototoxic effect on individuals hearing. Amino glycosides promote sensory cell degeneration in the cochlea, which usually starts in the basal turn and progresses to the apex and results in high-frequency hearing loss initially and followed by low-frequency hearing loss. As a result, conversational hearing may not be compromised in the early stages of amino glycoside Ototoxicity. Damage to the vestibular sensory cells of the crista-ampullaris causes vestibular dysfunction as ataxia and nystagmus with the absence of antecedent vertigo thus, the subject complaints of gait problems and oscillopsia [3].

Streptomycin is first amino glycosides, from Streptomyces griseous commonly used to treat tuberculosis. Some of the researchers have reported the damaging affinity of streptomycin on eighth nerve in which the earlier compounds, calcium and sulphate salts, mostly affects the vestibular section of the eighth nerve system resulting in balance problems along with deafness as consequence of continuous medication. There is dearth in understanding the cochleotoxic and vestibulotoxic effect of Streptomycin on inner ear in support with audio-vestibular investigations. Hence the present case report aims at highlighting the audiological and vestibular findings in a case presented with Ototoxicity after streptomycin intake.

CASE DESCRIPTION

A 67 year old male visited our institution with the complaint of ringing sensation in both ears more in Left ear than Right ear since 10 years. Detailed medical history of the client revealed that he was diagnosed with Acid Fast Bacillus (AFB) Tuberculosis and Taken 51 dosage of streptomycin as prescribed by the physician. Following which client started encountering with ringing sensation in his ears and reduced hearing sensitivity with no vestibular symptoms.

Hearing and Vestibular Assessment

Routine audiological and vestibular evaluation was carried out by administering Otoscope examination, Pure Tone Audiometry, Speech Audiometry, Impedance Audiometry, Reflexometry, Oto Acoustic Emission testing and Tinnitus Evaluation, along with Tinnitus handicap inventory, and dizziness handicap inventory and Fukuda stepping test.

The detailed history and background information was collected from the client prior to actual clinical

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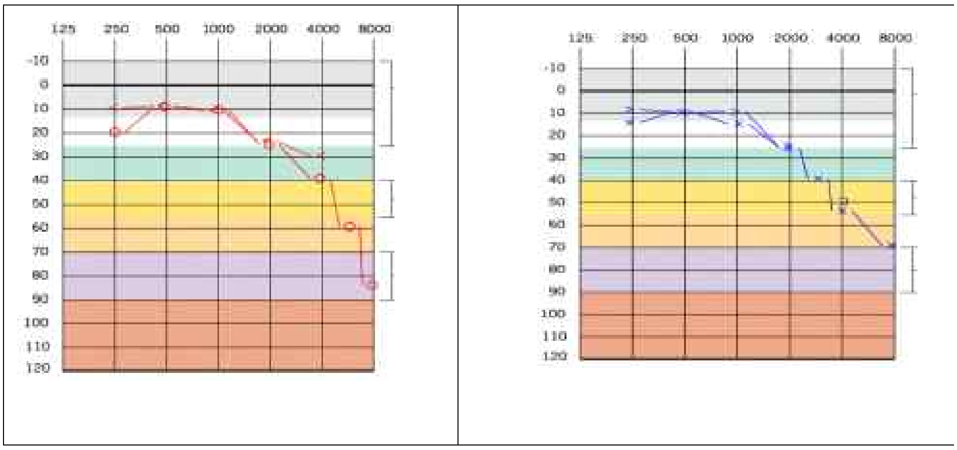
Table 1: Clinical findings of investigations

Investigations	Impression
Otoscope examination	Bilateral External auditory canal – Normal Tympanic Membrane- Visible with absent cone of light
Pure tone Audiometry	R- Minimal hearing loss with slope t high frequency L- Mild sloping Sensorineural hearing loss
Speech Audiometry	SRT- R- 20dB L- 30dB: SIS- R-95% L-95%: UCL- Greater than 100dB: Dynamic Range- above 70 in both ears
Immittance Audiometry	Bilateral A type tympanogram
Reflexometry	Ipsilateral and contralateral acoustic reflexes present except at 4khz in both ears.
Otoacoustic emission testing	Bilateral absent OAEs in both TEOAEs and DPOAEs (responses at low frequency bands).
Tinnitus evaluation	R- frequency matched at 2Khz ,intensity matched at 25 dB L- frequency matched at 3Khz ,intensity matched at 60 dB
Tinnitus Handicap Inventory	Grade 1- Slight or No handicap
Dizziness Handicap Inventory	Not perceived dizziness handicap
Fukuda stepping test	Negative

Figure 1: Audiogram representing hearing thresholds in right and left ear.



tests. The routine investigation was started by Otoscope examination to examine the external auditory canal and tympanic membrane status. To determine the hearing thresholds Pure Tone Audiometry was carried out using Harp inventis dual channel calibrated audiometer using TDH headphones and Radio ear bone vibrator across the frequencies from 250-8 kHz along with Speech audiometry testing. Immitance evaluation and Reflexometry was carried out to investigate the middle ear function and stapedius muscle functioning using Flute Inventis system. Distortion Product and Transient evoked Oto Acoustic Emission testing was done to check the functioning of outer hair cells, pitch and loudness matching was administered for tinnitus evaluation.

To clinically rule out the cochlear and vestibular symptoms certain screening checklists and subjective tests were also administered which are clinically feasible and sensitive. Thus, Fukuda stepping test, Tinnitus handicap inventory and dizziness handicap inventory were administered for the present client. The obtained test findings of all the subjective and electrophysiological responses were tabulated in table 1 along with the audiogram given below in the figure1.

DISCUSSION

The onset of ototoxic hearing loss may be missed as it may start at the end of aminoglycoside therapy with slow progression [4]. Hearing loss due to ototoxic effect of streptomycin is progressive in nature which can alter the hearing ability permanently and leads to hearing impairment. Several studies have reported that the streptomycin has an impact on cochlear hair cells and more susceptible to damage with reduced hearing sensitivity, tinnitus and balance problems as a consequence of streptomycin treatment[5] [6].The current observation &clinical findings in the present client showed deterioration of hearing ability with predominant tinnitus as early audiological symptoms after 51 dosage of streptomycin treatment without any reported vestibular symptoms in the present client. Thus the case report is in consonance with earlier investigations reported by various authors and supports the evidence based practice in these conditions.

CONCLUSION

Hearing loss remains a chronic disability in ototoxicity. Thus, the present study emphasizes the need of frequent monitoring of hearing and vestibular functioning due to persistent effect of ototoxic drugs even after the withdrawal of medications to ensure better quality of life.

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IMPACT OF COVID-19 PANDEMIC ON AUDIOLOGY CLINICAL PRACTICE OF STUDENTS IN INDIA

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INTRODUCTION

Corona virus disease-2019 (COVID-19), caused by the novel corona virus (severe acute respiratory syndrome coronavirus-2 – SARS-CoV-2) was first detected in December 2019 at Wuhan city of central Hubei province of China and spread to many countries within a short span of time. On 11th March 2020, the World Health Organization (WHO) declared it as a pandemic. COVID-19 pandemic is an extraordinary event that the last three generations had not witnessed since the Spanish Flu of 1918; the suffering and casualty rates being very high and are comparable to the two world wars.

The COVID-19 pandemic brought an unprecedented crisis for the community at large. Most audiological procedures require a direct patient contact while giving instructions, testing (such as placing headphones, probe tips, otoscope specula, electrodes, microphones, impression syringes, earmolds and hearing aids) as well as during counselling. The testing is conducted in a sound treated room or an enclosed chamber with no ventilation. In general, the risk of using instruments and the contact with patients and caregivers/bystanders cannot be overlooked.

NEED FOR THE STUDY:

- The general clinical practice of students has been observed in audiology department of the institute, where they play a vital role in assessing various hearing related problems of the patients. To assess the problems faced by students during COVID-19 impact on their clinical practices, during lockdown, there are limited data available especially in the Indian context. Thus, there is a need to study the Impact of COVID-19 pandemic on Audiology clinical practice of Students in India.
- If the Impact of COVID-19 pandemic on Audiology clinical practice of Students study is done here in India, it will be beneficial for those who are practicing here and also to know the clinical challenges faced by their peer groups during the pandemic.

AIM OF THE STUDY:

The present study was conducted with an aim to study the Impact of COVID-19 pandemic on Audiology clinical practice of Students in India using a cross-sectional knowledge, attitude and practices (KAP) survey.

OBJECTIVES OF THE STUDY:

- To study knowledge of COVID-19 and its protective measures among students of audiology clinical practice.
- To study attitudes of students of audiology clinical practice towards COVID-19 infection.
- To study practices of students towards clinical challenges and sources of information.

METHODOLOGY

The present study was conducted in two phases.

- Phase I: Development and validation of the questionnaire.
- Phase II: Data collection and analysis.

Phase I: Development and validation of the questionnaire

A self-reported questionnaire was used to gather data on the impact of COVID- 19 on audiology clinical practices of students practicing in India. This questionnaire was developed based on the information about COVID-19 on official websites of World Health Organization; Centers for Disease Control and Prevention, American Speech- Language-Hearing Association, Ministry of Health and Family Welfare, Government of India and discussion with subject experts. The developed questionnaire was content validated by 3 Audiologists, all with a minimum of 5 years of research and work experience. Every expert rated each question using a rating scale of irrelevant, somewhat relevant, quite relevant were included in the final questionnaire. All the questions proposed in the initial version were rated to be of relevance and hence retained in the final questionnaire. The questionnaire comprising of 30 items; demographic details, knowledge and attitudes towards COVID-19, and practices related to clinical challenges. These questions included yes-no-sometimes questions, checkboxes.

Participants:

The participants included 150 students within the age range of 20 to 30 years.

The students were selected based on criteria given below.

Inclusion Criteria:

- ASLP students of BASLP and MASLP were selected.
- Students who completed their internship during COVID-19 lockdown were selected.
- Students who practiced in clinics on regular basis were given utmost preference in the study.

Exclusion Criteria:

- Audiology working professionals / clinical supervisors were excluded.
- Students experiencing COVID-19 at the time of data collection.

Phase II: Data Collection and analysis:

A cross-sectional self-reported internet-based study design using convenience sampling was implemented for the present study.

Data Collection:

The finalized questionnaire was made available using Google Form, with an email link for the same. 150 students were randomly chosen from different colleges providing audiology education. The questionnaire link was shared with these students through their personal email ids and messaging service such as WhatsApp. No personal information was collected to maintain anonymity. All responses were saved on automatically with access only to the primary author.

The data collection was carried out from 12th May to 9th June 2021. The questionnaire was administered during the second stage of the COVID-19 spread and before the complete shutdown of nonessential/non-emergency services. The Google form started with a brief description of the present study followed by a formal consent statement. Only those participants who consented to participate could proceed further. The questionnaire was administered in English and took approximately 10 min for completion.

Data analysis:

The data analysis was done using descriptive statistics comprising of mean and SD for continues variables and frequency and percentage for discrete variables. All analysis was done using SPSS 24.

RESULT & DISCUSSION

The present study aimed at Impact of COVID-19 pandemic on Audiology clinical practice of Students and to assess their knowledge, attitude and practices.

Internal consistency:

In the current study to check for the internal consistency of the questionnaire Cronbach's alpha reliability coefficients was calculated. The item analysis was done for all the questions of questionnaire.

Table 1: *Cronbach's alpha reliability coefficient*

Cronbach's Alpha (α)	N of items
.844	30

*(Cronbach's α.>0.8 is considered as good).

Table 2: Mean Value of Age (N = 150)

Descriptive Statistics						
	N	Range	Minimum	Maximum	Mean	Standard Deviation
Age	150	10.00	20.00	30.00	23.7133	1.68027
Valid N (listwise)	150					

Table 3: Frequency Distribution of Qualification

Qualification				
	Frequency	Percent	Valid Percent	Cumulative Percent
Bachelor	79	52.7	52.7	52.7
Masters	71	47.3	47.3	100.0
Total	150	100.0	100.0	

Objective -1:

To study knowledge of COVID-19 and its protective measures among students of audiology clinical practice:

Table 4: Protective Measures

Q.No.	FREQUENCY			PERCENTAGE		
	NO	SOME TIMES	YES	NO	SOME TIMES	YES
11.Did you get vaccinated?	4	8	138	2.7	5.3	92
12.Did patients visiting institute were vaccinated?	14	114	22	9.3	76	14.7
13.Did you counsel patients to get vaccinated?	26	36	88	17.3	24	58.7

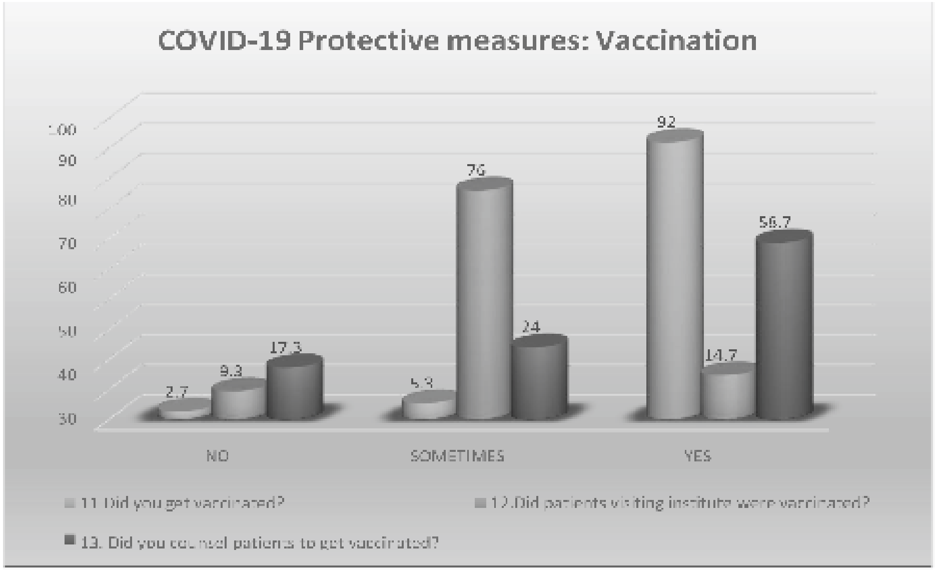

Figure 1: *Shows the Covid-19 Protective Measures*

Objective -2:

To study attitudes of students of audiology clinical practice towards COVID- 19 infection.

Table 5: *Attitudes towards COVID-19.*

Q.No.	FREQUENCY (n)			PERCENTAGE (%)		
	NO	SOME TIMES	YES	NO	SOME TIMES	YES
1.Did you worry about contracting COVID-19 during clinical posting?	12	47	91	8	31.3	60.7
2.Did you get COVID-19 while working in institute?	115	5	30	76.7	3.3	20
3.Did the COVID-19 preventive controls are in place in your institute?	26	23	101	17.3	15.3	67.4
4.Did the sanitizer was made available to student clinicians / patients?	23	18	109	15.3	12	72.7
18.Did you sanitize headphones and bone vibrators after each patient evaluation?	29	39	82	19.3	26	54.7

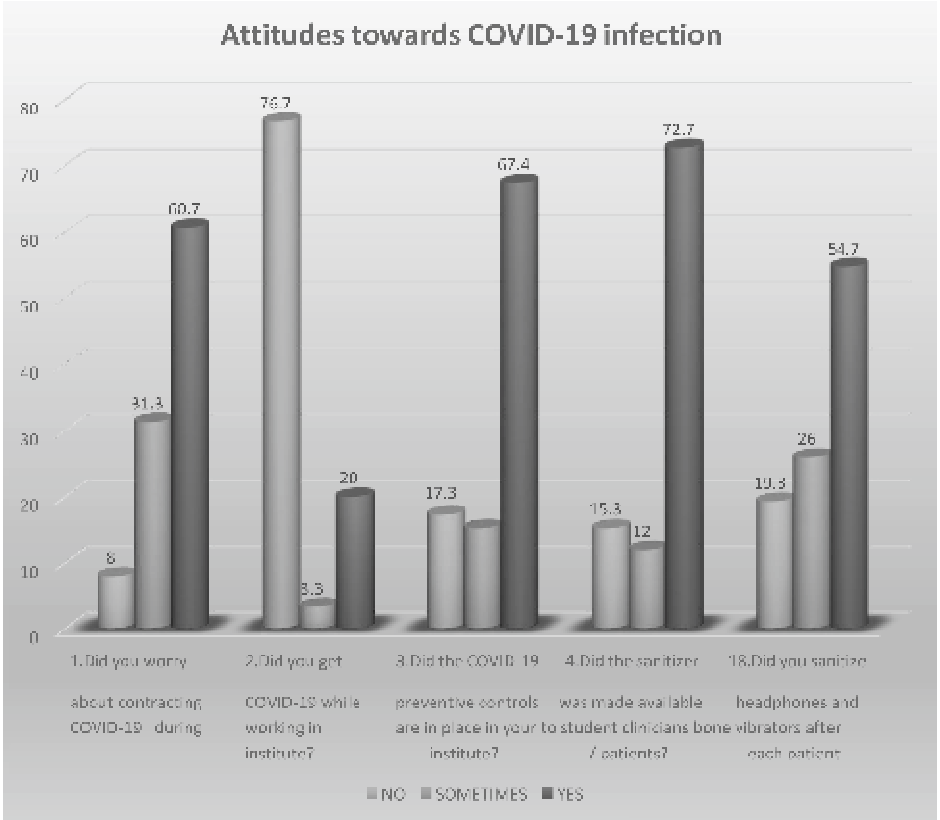

Figure 2: *Shows the Attitude Towards Covid-19 Infection*

Objective – 3:

To study practices of students towards clinical challenges and sources of information.

Table 6: Types of Preventive measures.

Q.NO	FREQUENCY			PERCENTAGE		
	NO	SOME TIMES	YES	NO	SOME TIMES	YES
5.Did you use various protective gears	18	15	117	12	10	78
6.Did wearing protective gears / personal barriers interfere communication with patients?	14	36	100	9.3	24	66.7
7.Did you follow COVID-19 protocol, during the close-proximity procedures in audiology?	11	24	115	7.3	16	76.7
8.Did the student clinicians follow social distancing?	26	34	90	17.3	22.7	60
9.Did the patients follow social distancing?	36	51	63	24	34	42
10. Did the COVID-19 experience influence your infection control procedures in the institutional environment?	27	36	87	18	24	58

Table 7: Clinical practice

Q.No.	FREQUENCY			PERCENTAGE		
	NO	SOME TIMES	YES	NO	SOME TIMES	YES
14.Did the clinical case load decrease during COVID-19 pandemic?	6	16	128	4	10.7	85.3
15.Did the clinical work hours per week reduce during COVID-19 pandemic?	37	16	97	24.7	10.7	64.6
16.Did the COVID-19 pandemic increase the audiological testing duration?	49	37	64	32.7	24.7	42.6

***Based on the responses, most of the participants would have faced clinical challenges related to audiological testing process*.**

Table 8: COVID-19 impact on Audiological testing process

Q.NO	Frequency			Percent		
	NO	SOME TIMES	YES	NO	SOME TIMES	YES
17.Did the COVID-19 pandemic impact the Pure Tone Audiometry testing process?	47	29	74	31.3	19.3	49.3
19.Did the COVID-19 pandemic impact the Impedance Audiometry testing process?	49	27	74	32.7	18	49.3
20.Did the COVID-19 pandemic impact the Speech Audiometry testing process?	41	37	72	27.3	24.7	48
21.Did the COVID-19 pandemic impact the OAE testing process?	49	36	65	32.7	24	43.3
22.Did the COVID-19 pandemic impact the BERA testing process?	30	36	84	20	24	56

23.Did the administration of special audiological tests reduced during COVID-19 pandemic?	43	26	81	28.7	17.3	54
25.Did COVID-19 pandemic interfere with test battery approach to audiological testing?	38	37	75	25.3	24.7	50

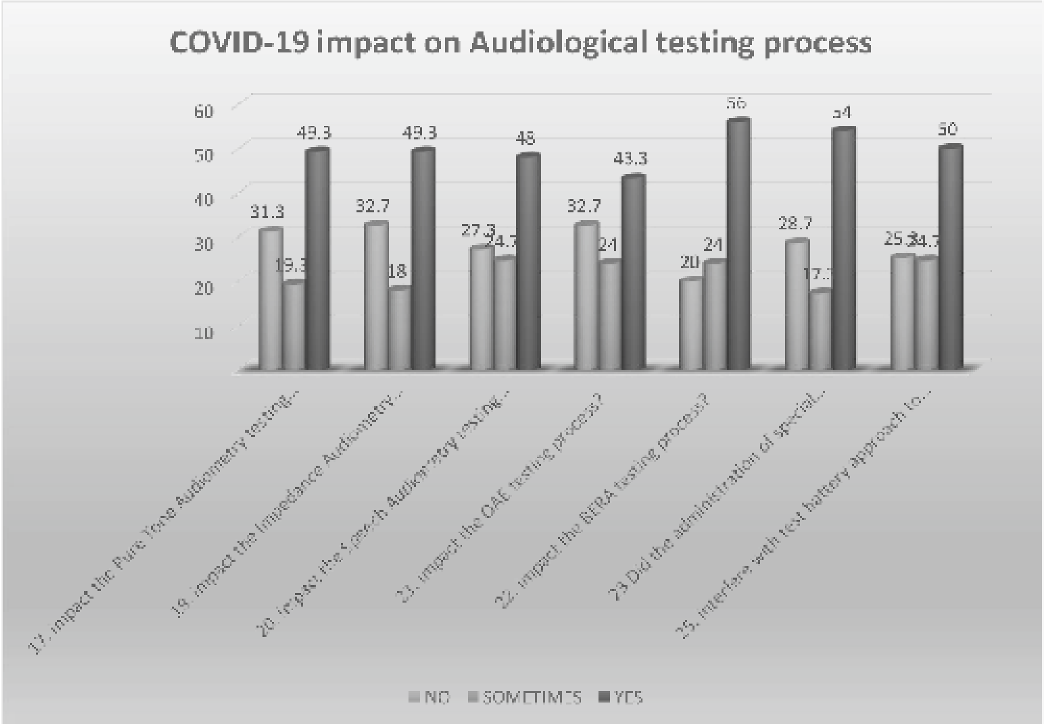

***Figure 3:** Shows the Covid-19 Impact on Audiological Testing Process*

The impact of COVID-19 was also seen on hearing aid programming, counseling, trouble shooting and also ear mold impression making process. Maximum number of students responded in a positive manner regarding all these audiological practices which were worst affected during this pandemic.

Q.No.	Frequency			Percent		
	NO	SOME TIMES	YES	NO	SOME TIMES	YES
24.Did the COVID-19 pandemic impact hearing aid programming procedure?	45	35	70	30	23.3	46.7
26. Did you provide any counselling services related to hearing testing / hearing aid usage?	8	13	129	5.3	8.7	86
27.Did the COVID-19 pandemic impact hearing aid troubleshooting?	53	33	64	35.3	22	42.7
28.Did the COVID-19 pandemic impact taking ear mould impression and ear mould making process?	41	36	73	27.3	24	48.7

29.Has your overall clinical work been impacted by the pandemic?	6	31	113	4	20.7	75.3
30.Did COVID-19 have an economic impact on your institute	17	22	111	11.3	14.7	74

DISCUSSION:

The students who participated in the present study were well distributed across the age range of 20-30 years. The gender distribution was skewed towards females, with almost 56% being females. However, this is not surprising as this gender variation in this course is well established. Bachelors is the minimum qualification required for practicing in India as an audiologist. Majority of the participants hold a master's degree followed by bachelors. The distribution across the clinical work setting was balanced between institution-based academic and clinical settings.

Existing knowledge levels of protection during COVID-19:

Vaccination is considered to be an effective way of protecting students from COVID- 19 infection because they are at risk of exposure to and transmission of COVID-19. More than 90% (92%) students were vaccinated. However, the patients visiting the institute were vaccinated or not was less commonly known. But, still during survey the question regarding vaccination was asked and then 76% patients said they were vaccinated partially (i.e., completed first dose and second dose yet to be taken), 14.7% said they have done with two shots of vaccination and 9.3% have not been vaccinated at all. The major difference among patients for being vaccinated and not vaccinated was due to knowledge. The lack of knowledge regarding vaccination and due to myths, misbeliefs and misinformation so many patients were not interested in getting their vaccination process done in fact the awareness being provided in all vaccination drives. As per the guidelines, each and every patient visiting institute were counseled to take the vaccine as soon as possible. However, only 58.7% students were able to correctly counsel the patients. The remaining students who counseled sometimes during postings were of 24% and 17.3% not at all counseled the patients according to the survey.

Attitudes towards COVID-19:

At the time of this survey, the students worried about contracting COVID-19 during the clinical postings. However, despite a stressful situation and good knowledge levels, these students exhibited changes in attitudes towards service delivery for patients. While working in institute during lockdown, 20% students got infected with COVID-19, 3.3% partially infected and 76.7% not at all infected. Due to the 20% positivity rate the students faced stressful situation to work. Further, almost 60% (60.7%) of the students were worried during clinical posting to provide services even to those individuals who were asymptomatic and not confirmed cases. When asked 'Did the COVID-19 preventive controls are in place in your institute', more than half of the participants replied in affirmation, 17.3% in negation while 15.3% choose to be neutral. These varied responses could be attributed to the proper sanitization

& housekeeping services at the institute during time of survey. Further, the stress associated with the outbreak and the feeling of being at risk of contracting it might have impacted their attitude towards their service delivery.

Practices towards clinical challenges and sources of information:

The students were asked to choose the type of preventive measures they would use while imparting clinical services. More than 75% (78%) used gloves, masks, eye protection devices, sanitizers, hand wash and maintained appropriate distance. However, based on the responses every student was aware about the social distance to be maintained. Possibly these practices are the outcome of the awareness drives after the current pandemic outbreak and not based on theoretical knowledge. The students exhibited positive practices of getting tested and following government guidelines for themselves as well as their patients.

SUMMARY & CONCLUSION

This is a survey study in which an online questionnaire was administered on 150 Students to provide an in-depth evaluation of current COVID-19 impact on Audiology clinical practice of Students in India. The majority of participants were optimistic about COVID-19 preventive practices. Despite the fact that the majority of them had access to protective gears (78%), their use was minimal and limited to specific procedures. Majority of the participants 72.7% said that the hand sanitizer was made available to them during clinical practices in all required / recommended instances. Regardless of whether the headphones and bone vibrators were used or not, the majority of participants preferred sanitizing them after each patient evaluation. Only 26% of the students sanitized sometimes.

Students must be professionally and socially responsible in their efforts to control spread of COVID-19 infection within the context of their institutional setting, thereby assuring COVID-19 free institutional environment.

CONCLUSION:

The present survey explored the changes in audiology practice during COVID-19 and the challenges encountered by students. COVID-19 shall pass eventually with lifestyle changes and the development of effective drugs and vaccines, but it has provided a once- in-a-lifetime opportunity for audiology students to learn and fully embrace new clinical technologies and service models for improved reimbursement, service delivery, and patient satisfaction. This study will also help the students adjust to the audiology practice to cope with the ongoing pandemic. This study extends the directions for tele-practice to become an integral part of routine practice.

CLINICAL IMPLICATIONS:

- It is used to improve the safety measures of students during the clinical practice.
- Used to monitor the student's general functioning skills enhancement amid pandemic.

LIMITATIONS OF THE STUDY:

- The first limitation is the small sample size; as a result, generalization of the data should be avoided.
- The study did not compare the background information with the knowledge and practice of COVID-19 infection control strategies.
- The practice patterns in the present study do not imply for speech language pathologists.

SUGGESTIONS FOR FUTURE RESEARCH:

1. Impact of post-training programs on students' knowledge, attitude, and practices, as well as improvements in COVID-19 infection rates.
2. Comparisons of COVID-19 infection control practices among practicing students who are serving in the government institutional settings compared to those who are in the private institutional settings.

QUALITY OF LIFE IN CHILDREN WITH COCHLEAR IMPLANTS: BEFORE AND AFTER CRITICAL PERIOD

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INTRODUCTION:

A cochlear implant is an electronic device that is surgically implanted and permits individuals with severe-to-profound hearing loss to regain or access some hearing. In many parts of the world, such intervention has become a routine procedure in cases of severe-to-profound deafness where conventional rehabilitation with acoustic stimulation is no longer helpful. It enables a deaf child to develop communication skills equal to those of the hearing peers, especially if the hearing impairment is diagnosed and cochlear implant can be performed early. Although a cochlear implant does not result in 'restoring' or 'curing' hearing loss, it does allow better perception of sound and helps a person with deafness to understand speech.

Studies suggest that cochlear implants have a large positive impact on recipients lives, particularly for improving communication. However, fewer studies have focused on the possible broader benefits, including health-related quality of life (QoL) in cochlear implant recipients.

The Glasgow children's Benefit Inventory (GCBI) is a generic patient-recorded outcome measure that was reported by Robinson; et al (1996) and has gained widespread popularity in Otolaryngology. It is designed to use post-intervention as a measure of change related to a specific surgical or medical intervention and on various aspects of the child's day-to-day life, without reference to any specific symptoms. It also applies to children of any age.

Cochlear implants are known to significantly improve the quality of life (QoL) of implanted children. Bruijnzeel; et al (2020) conducted a cross-sectional study on pediatric cochlear implant recipients and their parents. They evaluated the quality of life (Qol) using The Pediatric Quality of Life Inventory (PedsQL) QoL questionnaires. Results confirm that children using cochlear implants can reliably report better QoL between 8–12 years.

Quality of life outcomes for children with cochlear implants in India was investigated using the Glasgow children benefits inventory questionnaire by A N Dev, S Adhikari, S N Dutt et al, (2019) .Parents and caregivers have completed questionnaire and reported improved quality of life after cochlear implantation. However, a younger age at implant and longer experience were associated with greater quality of life improvements.

The quality of life in children with cochlear implant age on general functioning was investigated by Anna vinu Varghese and Dr. A Turin Martina (2017). Results revealed that there was significant difference in two groups on general functioning.

Harrison RV, et. al. (2005) observed distinct age of implant cut-offs and concluded that critical periods are important during development at present. Results also agree that children who were implanted before critical period performed better on the scale.

NEED OF THE STUDY:

Quality of life (QOL) has been measured in Glasgow children's Benefit Inventory (GCBI), where it plays a vital role in assessing a few domains related to the children's general functioning development. To assess the QOL of children using cochlear implants on parents, till date, there are limited data available especially in the Indian context. Thus, there is a need to develop GCBI in Telugu. India is a multilingual country, where Telugu is an official language.Further, if GCBI is available in Telugu, it would be beneficial for individuals who are native Telugu speakers. Apart from that, it would also be helpful to know the parental satisfaction on different domains in their native language.

AIM OF THE STUDY:

The present study aimed at adaptation of Glasgow children benefit inventory (GCBI) in Telugu and to compare general functioning skills related to the quality of life outcomes for children with cochlear implants before and after the critical period.

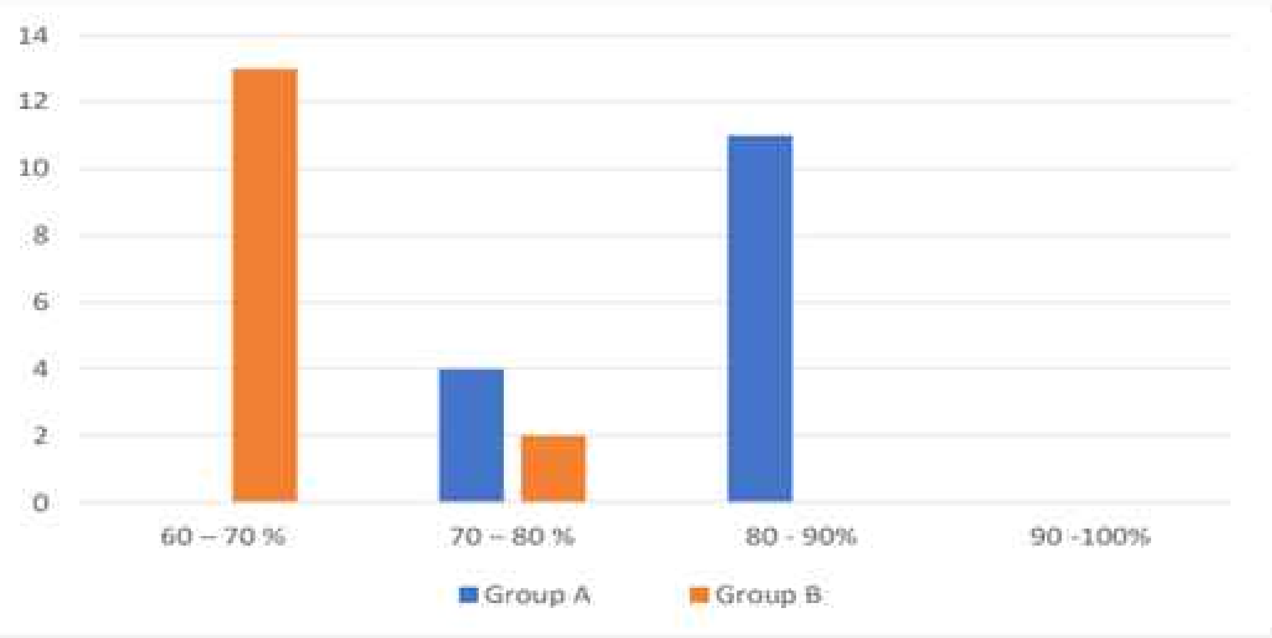
METHODOLOGY:

A total of 30 Telugu speaking parents of cochlear implant children between the age ranges of 0 to 10 years were recruited for the study. The study was carried out in two sections: Preparation of test material and Administration of Glasgow children benefit inventory on parents of children with cochlear implant. Scores are subsequently converted to a summary score between –100 and + 100, where a negative number indicates worsened QoL and a positive number reflects improved QoL.

RESULTS & DISCUSSION:

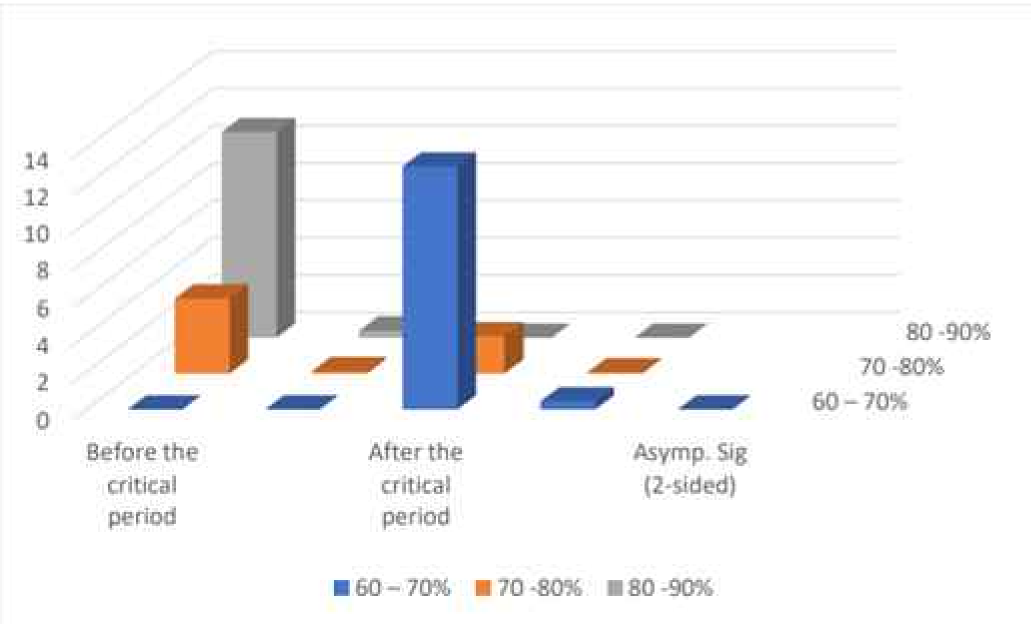
The English version of GCBI was adapted in Telugu for the current study with the permission of Author (Kubba and Haytham, 2014). The test material was translated from English to Telugu language using a forward and backward translation procedure which involved a five-step cross cultural adaptation process according to Guillemin, F. Bombardier, C.Beaton.D.1993.

The qualitative analysis outcome of overall benefit was reported by parents with cochlear implant in children before and after the critical period. Findings reveal that greatest possible benefit was observed in children implanted before the critical period. This results supports the study done by A N Dev, S Adhikari, (2019) investigated whether the age at which participants received their implant influenced the benefit that they experienced. There was a significant negative relationship between the age at implant and total Glasgow Children's Benefit Inventory scores. This suggests that if age at implant increased, the benefits experienced by children decreased.



(Graphical representation about qualitative analysis of group A and group B.)

Pearson Chi-square test was used to assess possible association between two groups resultingin significant association between two groups. Each domain was assessed and compared for both the groups. Scores of emotional, physical health, learning and vitality domains were greater for group A than group B which implies that children implanted before the critical period performed better than after the critical period. This finding is in line with the study conducted by Yawen Zhao, Ying Li, (2018) which found that the duration of CI use was positively correlated with five domains: communication, general functioning, self-reliance, wellbeing, and effects of implantation. This suggests that children who used CIs for a longer time had higher HRQoL.



Graph Shows the Pearson Chi-square test.

CONCLUSION:

QoL appears to improve following cochlear implantation in children when measured with the Glasgow Children's Benefit Inventory. Greater improvements are seen with earlier implantation. Parents of children who had undergone cochlear implant surgery reported improved QoL following implantation, with improvements in both total Glasgow Children's Benefit Inventory scores and domain scores.

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TRANSLATION AND VALIDATION OF PARENT EVALUATION OF AURAL & ORAL PERFORMANCE IN CHILDREN {PEACH} QUESTIONNAIRE IN URDU LANGUAGE

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Keywords: *Hearing loss, auditory intervention, assessment, PEACH, adapted scale, Urdu.*

INTRODUCTION

Hearing is an important modality through which the learning process happens. Loss of hearing is a major problem in pediatrics which hinders the normal development of speech and language henceforth which affects the normal development of the child. Hearing is the most effective modality for the teaching/learning of spoken language, reading and cognitive skills (Cole &Flexer, 2007). A primary difficulty of hearing loss is that it interferes with the brain's access to the sound. (Cole & Flexer, 2007). Early identification and intervention have a positive impact on the speech and language outcomes of young children with hearing loss (Carney & Moeller, 1998; Yoshinaga-Itano, Sedey, Coulter, & Mehl, 1998). Questionnaires are easy methods to keep track of progress of any rehabilitation programs. Well designed, standardized tools help audiologists and other professionals involved with the progress of the child to get a feedback as to the nature and extent of progress achieved and to take decisions as to whether any further changes to amplification or device types are in order. PEACH (The Parents' Evaluation of Aural/oral performance of Children) is a Questioner which provides important information for determining the effectiveness of provided amplification as well for determining the effectiveness of different frequency responses (Ching& Hill, 2001). At present, PEACH is one such most commonly agreed upon tool internationally. Adapting this to Indian languages would be practical benefit to our clinical work.

NEED AND AIM FOR THE STUDY:

There is a need to develop or translate a tool that measures the outcome of hearing aids in children with hearing impairment especially for Indian population. The present study focused to translate and validate the original English version of PEACH into the regional language, Urdu for its utility for hearing aid validation and outcome measures purpose for children with hearing loss. The present study is aimed to translate the original English version of PEACH questionnaire into Urdu language so that it can be validated on children with hearing impairment who are using hearing aids and to compare it across various age groups and different types of amplification.

METHODOLOGY:

A total of forty parents of children with normal hearing and thirty parents of children with hearing impairment with child's age ranging from 2–10 years were included in this study to delineate development of auditory behaviors in typically developing normal children and hearing-impaired children. All the hearing-impaired children had moderately-severe to profound sensorineural and mixed hearing loss bilaterally. Parents belonged to middle socio-economic group and had received education equal to SSC. Initially by taking the authors permission PEACH scale was translated and adapted into Urdu language with the help of two audiologists and who 1 linguist. The questionnaires in Urdu version were seen for syntactic structure, semantic content, familiarity and ambiguity.

The participant signed an informed consent and adapted PEACH items were administered on the participants. It includes 13 questionnaires that assess: Use of amplification and loudness discomfort, Listening and communicating in quiet and noise, Use of telephone and Responses to environmental sounds. The Urdu PEACH was provided to the parents/primary caregivers and each question was explained by the authors. An interview session was arranged to clarify any doubts or suggestion. Later they were asked to observe the auditory and oral behavior oftheir children in relation to each question for a period of two weeks. They were also instructed to note down the as many examples of responses for each question. After completion of test items, after one week another interview session was arranged with parents/caregivers to clarify the recorded unclear examples of response. The clarification will help to increase the accuracy of response behaviour. Scoring was done by correlating the parent's verbal and written response. Each response to a question was scored on a five-point rating scale ranging from 0 to 4. The descriptive criterion for rating was as follows: score of 0 indicates Child did not demonstrate any auditory response, 1- Auditory response occurred 25% of the time, 2- Auditory response occurred 50% of the time, 3-Auditory response occurred 75% of the time, and score of 4 indicates auditory response occurred more than75% of the time. Statistical analysis was carried out using SPSS software both descriptive and inferential was carried out with the consultation of statistician.

RESULTS AND DISCUSSION:

The present study aimed at adaptation of parents rating of aural-oral performance (PEACH), a subjective outcome measure in Urdu. The Cronback's alpha equalled 0.94 which exceeds the 0.70 acceptable criteria for internal consistency of questionnaire; this is a measure of reliability indicating that questionnaire items measure the same overall construct (i.e., functional auditory behaviours). Total of 70 subjects which were divided into two groups, Group A consisting of 40 subjects with normal children and Group B consisting of 30 children with Hearing Impaired using Hearing Aids. The mean age of Group A is 58.50 with SD 33.8 and the mean and standard deviation of Group B is 46.0 and 25.9 respectively. The subjects of Group A were divided into 3(1-3 years, 3-5 years and above 5 years) to know the developmental trends in PEACH scores. Age group 3yrs and below obtained lowest score and ceiling values were seen by 5 yr age group.

For group A, independent samples t-test was conducted to evaluate scores between three groups of children: 3yrs and below (n = 10), 3-5 yrs (n= 18) and those 5 yrs and older (n = 12). Between groups, the Levene's test of equality of variance was violated (F = 80.014, df = 27, p < 0.001). With equal variances not assumed, overall PEACH scores between age groups were significantly different (t = -6.528, p < 0.001). Children in the younger group, 1-3yrs age group (n=10) had obtained significantly lower scores (mean = 28.35) than children in the other two groups, (3-5yrs=26.75, 5yrs and above=33.83).

For group B, descriptive statistics were applied and following results were obtained. The Mean age was 64.27 months. They were classified into three age groups, like in normal children group for analysis of age effects. Average for age group 1-3 yrs is 24 months, 3-5 yrs is 43.44 months and for 5yrs and above was 83.64 months. One way ANOVA test was conducted to evaluate scores between three groups of children: 3yrs and below (n = 02), 3-5 yrs (n= 13) and those 5 yrs and older (n = 15). With equal variances not assumed, overall PEACH scores between age groups were significantly different (F= 1.52, 0.21, 0.31 respectively for Total Score, Score for Quiet and Noise, p > 0.001).

The paired t test was carried out to compare scores for quiet condition and noise condition. The result suggests that the scores obtained for quiet condition and Noise condition were significantly different for all age group. The Scores for Noise were poorer in all age groups. The scores were quiet were better for all three groups, than the scores for noise sub scores. It shows even with amplification children with hearing impaired were not showing adequate improvement in auditory behaviour in social surroundings. In environment their auditory only in quiet environment like home, behaviour is similar to children with normal hearing.

SUMMARY AND CONCLUSION:

The results of this showed that scores were influenced by hearing loss, duration of therapy and amplification strategy. Scores also showed development trend. The small sample size with the current analysis may have provided just an insight into the impact of noise on children involved in this study, regardless of whether or not they have another medical issue or complex hearing aid factor. An item analysis carried out in a larger sample study may provide further insight about the performance of children with different levels of hearing loss within the various listening situations included in the PEACH. This further work may help support clinicians' decisions about when to apply technologies to combat noise in the listening environment, for example. Accounting for the child's auditory characteristics in an individualized and accurate way, selecting the appropriate hearing aid characteristics and verifying the hearing aid's performance, results in a good auditory outcome at both the early and later stages of Hearing aid use.

CLINICAL IMPLICATIONS OF THE STUDY:

The PEACH Urdu version can be used as effective tool in measuring the outcomes or benefit of hearing aids in children with hearing impairment having Urdu as their mother tongue. This study aims at measuring the efficacy of Urdu version with respect to original version in terms of internal reliability and validity of the questionnaire itself.

LIMITATIONS OF THE STUDY

The present study had a limited number of participants. Children with Mild to Moderate degree of hearing loss were not included in the study, this prevented characterization of score by degree of hearing loss for the individual outcome evaluation tools.

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EVALUATION OF TEMPORAL PROCESSING ABILITIES IN INDIVIDUALS WITH HYPERTENSION

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Keywords: *Temporal Processing, Hypertension, Cochlear and neural damage*

ABSTRACT

Cochlear damage is caused by the damage to the sensitive hair cells inside the inner ear or damage to the auditory nerve. Several studies were carried out to see the effect of hypertension in hearing loss. The findings indicate hypertension causes degeneration of the inner ear due to alteration in microcirculation, thus accelerating the aging process in inner ears. Studies also suggest cochlear or neural damage in individuals with hypertension. It is well known that normal cochlear/neural functioning is important for auditory temporal processing. Since, there are cochlear or neural damage reported in individuals with hypertension, it is important to study the temporal processing abilities in them. The aim of the study was to assess temporal processing abilities in individuals with and without hypertension. In the present study, two groups of participants were included. Experimental group included 15 participants with hypertension and the control group with 15 participants without hypertension. Temporal processing was assessed using the "mlp" tool box which implements a maximum likelihood procedure in MATLAB. To check for temporal resolution, gap detection test, temporal modulation transfer function (8Hz, 20Hz, 60Hz, 200 Hz) and duration discrimination for complex tone was done. To check for temporal ordering, Duration pattern test was done. The results of the study indicate that the temporal processing ability (all four tests) was significantly poorer for individuals with hypertension compared to the control group. This could be because of reduced frequency selectivity and poor temporal coding as well as due to difficulty responding to rapid change in the envelope of sound over time because of cochlear and neural damage seen in individuals with hypertension.

INTRODUCTION:

Hypertension is a condition in which the blood vessels have persistently raised pressure. Blood pressure is created by the force of blood pushing against the walls of blood vessels (arteries) as it is pumped by the heart. The higher the pressure the harder the heart has to pump [1]. Over time, the constant pressure overload causes accumulating damage that eventually becomes more than your circulatory system can handle, often leading to serious health problems [2].High blood pressure is ranked as the third most important risk factor for attributable burden of disease in South Asia [3]. Hypertension (HTN) exerts a substantial public health burden on cardiovascular health status and healthcare systems in India [4].The rates for Hypertension in percentage are projected to go up to 22.9% and 23.6% for Indian men and women, respectively by 2025[5], [6]. Recent studies from India have shown the prevalence of Hypertension to be 25% in urban and 10% in rural people in India [7]. When the blood pressure is high, the blood vessels are damaged. This damage is not centered in one area of the body; the entire body is affected, including ears. When the blood vessels in the ears are damaged and have a fatty plaque buildup in ears and hearing could be impaired[2].

AIM OF THE STUDY:

To assess temporal processing abilities in individuals with and without hypertension.

METHODOLOGY:

The participants will be divided into two groups.

Experimental group: 15 participants with diagnosed hypertension will be selected randomly, between the age group of 25 and 45 years. Patients with arterial blood pressure ≥ 140/90 mm of Hg will be considered positive for high blood pressure. They should be under medication for 2 or more than 2 years. Those patients who have hearing loss and wear hearing aids and those who are undergoing treatment for any neurologic disorders will be excluded from our study. The participants will have a pure tone average of less than 25 dB in both ears from 250 Hz to 4000 Hz. They should have 'A' or 'As' type tympanogram with acoustic reflexes present (Ipsi and Contra) from 500 Hz to 4000 Hz. They should have no history of any otological symptoms.

Patients with previous history of specific hearing disorders (such as rubella and head injuries), specific metabolic disorders (such as diabetes) and specific vascular disorders (such as strokes), and also individuals who worked or had worked in an environment that could cause noise-induced hearing loss, patients with kidney diseases and with prior history of hospital stay or ingestion of potentially ototoxic medication or drugs will not be considered for the study.

Control Group: 15 participants without hypertension who are selected randomly will be included in the study. The age group of the participants will be 25–45 years. Same inclusion and screening criteria will be applied to these participants as for the hypertensive patients.

The hearing will be assessed by means of the conventional audiological evaluation. Detailed case history will be taken as a closed set interview about the auditory and vestibular disorders symptomatology, presence of tinnitus, as well as exposure to hearing harmful agents, such as occupational or leisure noise, ototoxic drugs and general health conditions.The frequencies range from 0.25 to 8 kHz, for the air conduction and 500 to 4 kHz for the bone conduction will be tested.Tympanometry will be done using 226 Hz probe tone using a calibrated middle ear analyzer. Acoustic Reflex thresholds will be determined for 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz both ipsilaterally and contralaterally.

Assessment of Temporal Processing: Temporal processing will be assessed using "mlp" tool box which implements a maximum likelihood procedure in MATLAB[8]. The entire test will be done using mlp tool box except for temporal ordering. Temporal ordering would be checked using duration pattern test and will be done using the test CD which will run on the laptop. In all of the psychophysical tests, stimuli were presented monoaurally at an intensity of 60 dB HL.

Duration discrimination for a complex tone: In this test, the tone has four harmonics (f0 =330 Hz, mi4). The tone has raised onset and off gates of 10ms. The participants have to identify the longest tone in a 3 alternate forced choice (3AFC) method. This test assesses the temporal resolution abilities.

Gap detection: A band of 750 ms Gaussian noise has a gap in its temporal center. Gap duration is varied according to the listener's performance. The noise has 0.5ms cosine ramps at the beginning and end of the gap. In the 3AFC task, the standard is always a 750 ms broadband noise with no gap whereas the variable contains the gap. This test assesses the temporal resolution.

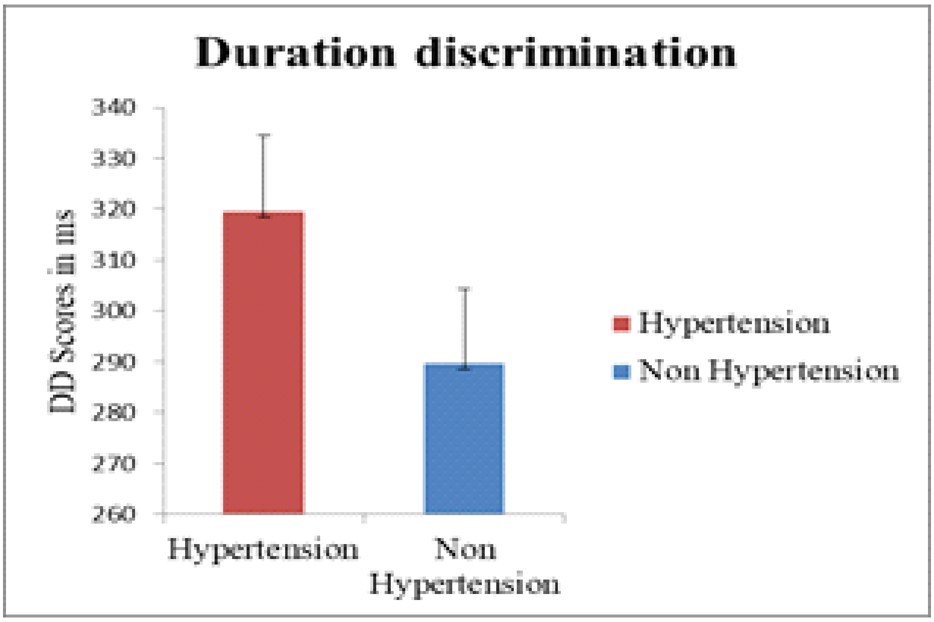
Temporal-Modulation Transfer Function (TMTF): It is a sinusoidal amplitude modulation (SAM) noise discrimination task. A 500ms Gaussian noise is sinusoidally amplitude modulated at 8Hz 20Hz, 60Hz, 200Hz. The depth of the modulation is expressed as 20log(m), where m is a modulation index that ranges from 0.0 (no modulation) to 1.0 (full modulation). The participants have to identify which interval has the modulated noise. Noises will have two 10 ms raised cosine ramps at onset and offset. The threshold is the modulation depth (in dB).This test assesses the temporal resolution of envelope.

Temporal Ordering using Duration pattern test: The duration pattern test was administered in the manner described by Gouri (2003). A 1000 Hz pure tone with two different durations (i.e., short 250 msec and long 500 msec) was used as the stimuli. By combining these two durations in three tone patterns, six different patterns were generated. The inter stimulus interval was 250msec within a tone sequence and 6 sec between two tone sequences. Following practice trials, 30 test items were administered. Participants were asked to verbally repeat the sequence. This test assesses the temporal ordering.

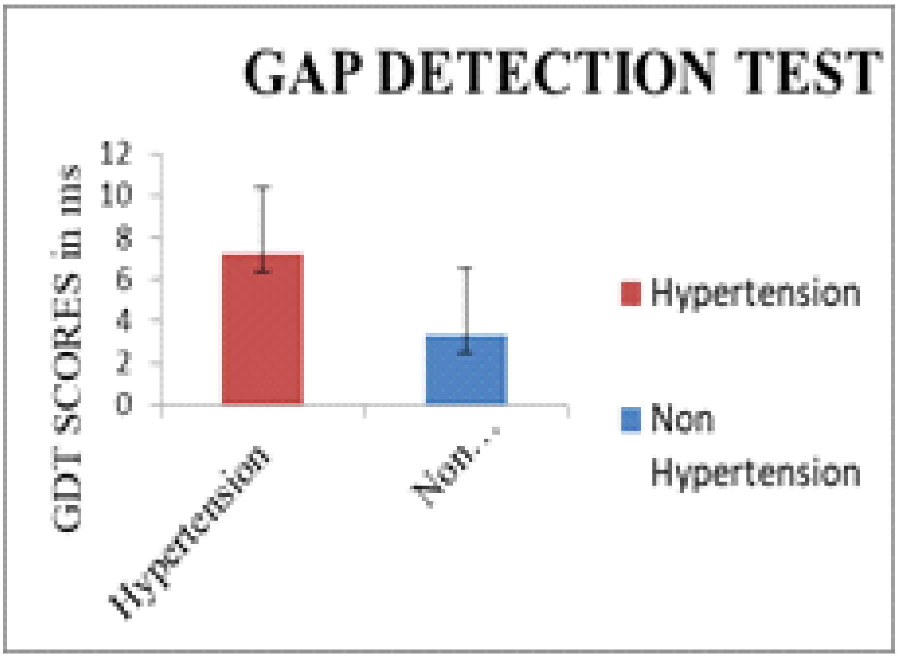
RESULT:

In the study, two groups of participants were included. The experimental group included individuals with hypertension and the control group included individuals without hypertension. In each group, 15 participants were considered for the study. The data obtained was analyzed using the SPSS software version 20.0. Shapiro Wilk test of normality and data was found to be not normally distributed ($p<0.05$).Hence, non-parametric inferential statistics were done. Mann-Whitney U test was administered for between group comparison and the effect size was also calculated. The results of the study are explained under following headings:

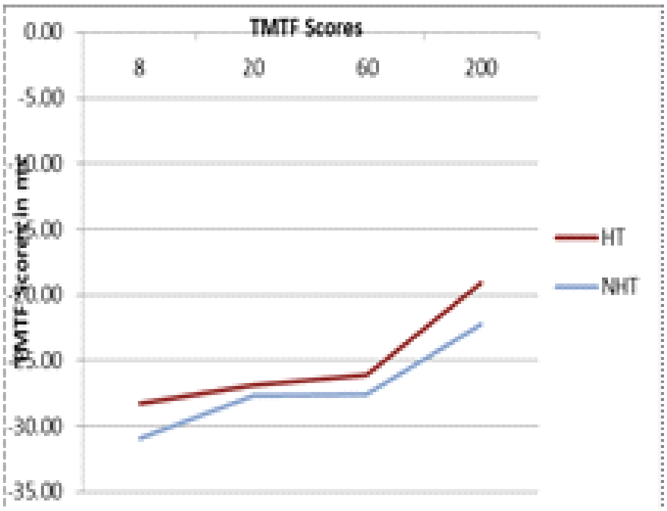
1.1 Comparison of Duration discrimination for a complex tone in individuals with and without hypertension: It revealed a significant difference between the two groups ($Z= -3.720$, $U= 198.50$, $p<0.01$). The effect size is 0.48. The mean duration discrimination for a complex tone scores for both the groups have been represented in figure 1.1.



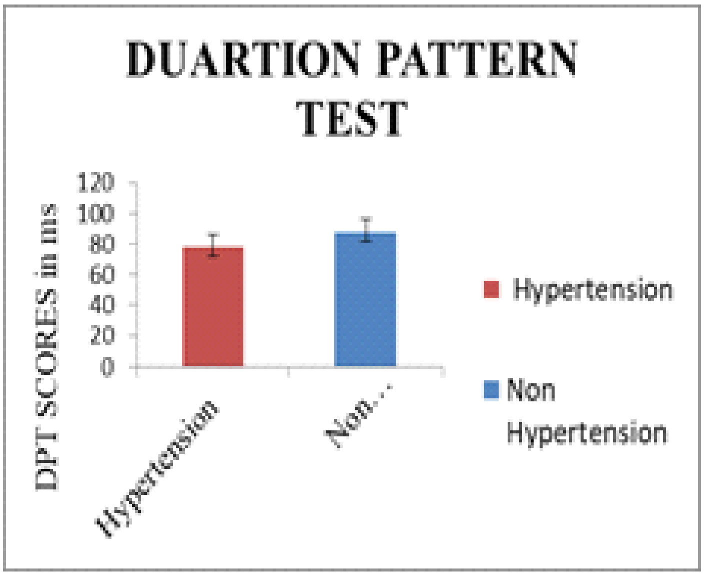
1.2 Comparison of gap detection test in individuals with and without hypertension: It revealed a significant difference between the two groups. (Z= -5.55, U = 57.500, p<0.01). The effect size is 0.73. The mean duration discrimination for a complex tone scores for both the groups have been represented in figure 1.2.



1.3 Comparison of Temporal-Modulation Transfer Function (TMTF) test in individuals with and without hypertension: It revealed a significant difference between the two groups.(For 8Hz, Z= -2.53, U = 278.50, p<0.01), (For 20Hz, Z= -2.063, U = 310.50, p<0.01), (For 60Hz, Z= -.584, U = 410.50, p<0.01), (For 200Hz, Z= -3.54, U = 210.50, p<0.01). The effect size was, for 8Hz=0.32, 20Hz=0.26, 60Hz=0.075, 200Hz = 0.45.The mean Temporal-Modulation Transfer Function (TMTF) test at four frequencies (8Hz,20Hz, 60Hz, 200Hz) scores for both the groups have been represented in figure 1.3.



1.4 Comparison Of Temporal Order for Tones test in individuals with and without hypertension: It revealed a significant difference between the two groups. (Z= -4.484, U = 150.500, p<0.01). The effect size is 0.57. The mean Temporal Order for Tones test (Duration Pattern Test) scores for both the groups have been represented in figure 1.4.



DISCUSSION:

Temporal resolution is known to influence speech perception in challenging listening conditions [9] and is susceptible to auditory processing problems. Hypertension is a disease whose biomarker is blood pressure. The authors have utilized blood pressure as the means for defining the presence and severity of hypertension [10]. The major causes of hypertension are Obesity/Overweight, Metabolic Syndrome and Insulin Resistance, High Cholesterol and Dyslipidemia, Low Birth Weight [11].Hypertension, the most common vascular disorder, may facilitate structural changes in the heart and blood vessels. High pressure in the vascular system may cause inner ear hemorrhage, which is supplied by the anterior inferior cerebellar artery, which supports the inner ear artery and is divided into cochlear artery and anterior vestibular artery [12], which may cause progressive or sudden hearing loss[13]. This circulatory system pathology may directly affect hearing in a number of ways. One of the vascular physio pathological mechanisms described is the increase in blood viscosity, which reduces capillary blood flow and ends up reducing oxygen transport, causing tissue hypoxia, thus causing hearing complaints and hearing loss in patients. Moreover, arterial hypertension may cause ionic changes in cell potentials, thus causing hearing loss[14].

Lozza et al. (2006) did a study on hypertension as a factor associated with hearing loss, in which the hearing was assessed using tonal threshold audiometry and systematized questionnaire about hypertension and the use of medication for blood pressure. And there was a significant association between blood hypertension and hearing loss. Hearing loss in the population under study suggests that hypertension is an accelerating factor of degeneration of the hearing apparatus due to aging.

Agarwal et al.(2013) studied 150 patients with diagnosed hypertension, selected randmly, who were receiving medication for hypertension and 124 patients without hypertension between the age group of 45 and 64 years included in the study. And the results revealed that the increase in hearing threshold was greater in grade 3 hypertension (≥ 180/ ≥ 110 mm Hg.) with the threshold increasing at higher frequencies.

Lozza et al.,(2014) aimed to study the performance on pure tone audiometry and otoacoustic emissions in hypertensive patients. The HT group had a statistically significant decrease in responses to DPOAE as compared with the control group at OAE tests performed especially at 6000 Hz frequencies. And they concluded that the cochlea, due to its vascular physio dynamic mechanisms, is one of the target organs on which HT may have an effect. And suggest that HT can cause cochleopathologic changes, including dysfunction of outer hair cells, in cases with tinnitus, presbycusis and even in preclinical cases.

Thus, all the above studies suggest cochlear or neural damage in individuals with hypertension. The reason for hearing impairment in individuals with hypertension is explained as the increase in blood viscosity that reduces blood flow in the capillaries, thereby reducing oxygen transport. This causes tissue hypoxia (reduced oxygenation), thus causing hearing loss in patients [2]. Inner ear damage can occur due to high pressure in the vascular system. This can cause progressive hearing loss. Hypertension causes degeneration of the inner ear due to alteration in microcirculation, thus accelerating the aging process in inner ears [2]. It is well known that normal cochlear/neural functioning is important for auditory temporal processing.

Auditory temporal processing ability can be defined as the perception of sound or change in a sound within a defined time. The auditory temporal processing is an essential component of most auditory processing capacity, which can be seen at several levels, ranging from neuronal sensitivity to the effects of stimulus onset time, to cortical processing of auditory information such as speech stimuli. Since neural synchrony is necessary for auditory temporal processing, when cochlea is damaged, the neural synchrony is altered due to which the auditory temporal processing is affected. Previous studies have also reported neural damage in individuals with HT. Therefore, there might be temporal processing deficits in patients with hypertension.

In the present study, the results revealed there was significant reduction in Duration Discrimination threshold for a complex tone, Gap Detection and Temporal Modulation Transfer Function (TMTF) test between hypertension group and non-hypertension group. This might be because of reduced frequency selectivity and poor temporal coding as well as due to difficulty in responding to rapid change in the envelope of sound over time because of cochlear and neural damage in individuals with hypertension. As well as there was significant reduction in Temporal Order for Tones test in individuals with and without hypertension. This might also be due to cognitive processes like perception, attention, working memory, movement control or language in hypertension patients compared to non-hypertension patients. Since temporal ordering is important for central nervous system function, due to lack of blood and oxygen supply to CNS, there might be damage in the CNS due to which poorer scores are obtained. However, the effect of hypertension on functioning of the central auditory nervous system should be further studied.

CONCLUSION:

The results of the study indicate that the temporal processing ability (all four tests) was significantly poorer for individuals with hypertension compared to the control group. This could be because of reduced frequency selectivity and poor temporal coding as well as due cochlear and neural damage seen in individuals with hypertension.

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HEARING IMPAIRMENT AND DAILY-LIFE FATIGUE: A QUALITATIVE STUDY

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ABSTRACT

The ear is a sensitive organ. Damage to the ear can cause the ear to malfunction. In India, approximately 63 million people suffer from hearing loss. Hearing loss affects the individuals in many ways including fatigue. Fatigue is a co-morbid which is routinely defined as a symptom, indicative of physical or mental disease or a consequence of the treatment of diseases.

This study aimed to investigate hearing impairment related fatigue and effects on day today life (in the Personal and Professional life) and to investigate impact of hearing aid usage on fatigue. The objectives of the study are to (i) understand fatigue, with patient's perspective by holding descriptive explanation. (ii) To administer questionnaire on related living style, hearing aid status, tinnitus, work status of individual participants. (iii) To understand perspective of patient, about impact of hearing aid use on fatigue, in the form of suppression or enhancing it.

A total of 30 hearing impaired individuals with age range of 23 to 75 years participated. They had diverse working and living status that varied in terms of hearing loss (Mild – Severe) and hearing aid utility status. The 'Semi-Structured Question Guide: Hearing Impairment and Fatigue' questionnaire was administered on all the participants.

he Statistical Analysis was done using detailed reading and running of text analytics. To validate the responses "Z test" was carried out on the obtained data by dividing the questionnaire data into two parts.

Older and middle aged respondents have expressed that they have severe difficulty with the hearing impairment and also difficulty in usage of hearing aids in comparison to younger ones. However they got used to with hearing impairment and hearing aids. Some respondents also felt, stated that programming, highly sophisticated and many featured hearing aids can be beneficial. Further, it was stated that use of Hearing Aids not all benefitted in solving hearing related fatigue.

Based on the Z test results stated that the persons with hearing impairment likely to face lot of stress, fatigue and strain. Patients should take breaks from hearing for some time to cope up at work; hearing aids being better programmed will help the hearing impaired persons.

People with severe hearing loss can have listening breaks during the heavy (busy) working day. This study provides documentation regarding the reasons for non regular use of hearing aid due to fatigue. This information also can be used by professional in understanding fatigue with hearing impairment on patient's perspective. Clinicians can suggest listening breaks for patients according to the level of strain and fatigue patients are complaining about.

Majority of the respondents indicated that the hearing loss caused them with difficulties at professional and personal front, they could not lead the life of a normal Individual. The Hearing Aids gave them the required support to lead relatively normal life, but to some extent only. Overall the hearing impairment caused lot of fatigue and tiredness to most of the patients but not all. Similarly hearing aids caused inconvenience but to some extent reduced the fatigue and related issues.

Key words: *Fatigue, Hearing Impairment, Hearing Aids, Stress, Strain and Tiredness.*

INTRODUCTION

The ear is a marvelously complex and sensitive organ. Unfortunately, damage to the organ, whether through disease, physical insult, long term exposure to excessive noise, some drugs or simply the effects of aging, can cause the ear to malfunction. In India, approximately 63 million people suffer from hearing loss. Hearing impairment cannot be seen and hence its effects are not visible to others, so deaf suffers in silence. Unlike blindness, deafness often provokes ridicules rather than sympathy. A deaf person is so isolated from family and friends and greeted by unsympathetic attitude he/she is often depressed and needs psychological counseling.

Fatigue is a complex construct that has been defined many ways. In fact, a standardized definition does not exist. Definitions found in the literature vary, in part, based on the discipline of the person describing the construct (e.g., layperson, physiologist, cognitive psychologist, physician) and the focus of their study (e.g., muscle fatigue in athletes, cognitive fatigue in multiple sclerosis).

Fatigue has also routinely been defined as a symptom, indicative of physical or mental disease (e.g., multiple sclerosis, depression) or a consequence of the treatment of diseases (e.g., chemotherapy). This range of definitions complicates comparisons across studies and the generalization of research findings. Fatigue is regularly described as co-morbid within this large group of people (hearing impaired) (Bess and Hornsby 2014; Hetu et al. 1988), but there is little research in this area.

REVIEW OF LITERATURE

Previous studies investigating fatigue and hearing loss have tended to use self-report outcome measures. The majority of this research has shown that people with an audiometric hearing loss report more fatigue than those without, however fatigue scores have tended to correlate with hearing handicap scores rather than audiometric thresholds (Alhanbali et al. 2017, 2018; Hornsby and Kipp 2016; Wang et al. 2018). Other studies have indirectly observed increased fatigue in people with hearing loss by reporting outcomes such as need for recovery after the working day (Nachtegaal et al. 2009). Such studies introduce the idea that the amount of communicative activity undertaken by an individual will affect the level of fatigue they experience. Additionally, the very small amount of research into the effect of wearing hearing aids on fatigue has shown an objective benefit (reduced performance decrement over time) but not a subjective benefit. Notably, objective and self-report measures of fatigue have been found not to correlate (Alhanbali et al. 2017; Hornsby 2013). Common to the research topic as a whole is the use of dissimilar outcome measures, some of which claim to measure fatigue directly, while others use indirect measures of fatigue.

NEED FOR THE STUDY

Fatigue with hearing impairment has multi-faceted nature. Hearing impaired individual most often complaint of fatigue and energy drain, being hearing professionals we need to understand the gravity of fatigue related to hearing impairment. As the fatigue is more complex hence hard to quantify and understanding is low, to provide better management we need to have better understanding about fatigue related to the hearing impairment and its influence on the status and quality of life. We as professional should also relate the extent of fatigue due to hearing impairment or it varies broadly among people and also what is the experience of fatigue in everyday life for people with hearing impairment.

AIM OF THE STUDY

To investigate hearing impairment – related fatigue and effects on day today life. (In the Personal and Professional life) and also to investigate impact of hearing aid use on fatigue.

OBJECTIVE OF THE STUDY

To understand perspective of patient, about impact of hearing aid use on fatigue, in the form of suppression or enhancing it.

METHODOLOGY

SUBJECTS: Total 30 hearing impaired individuals were selected with age range of 23 to 75 years, with diverse working status, living status that varied in terms of hearing loss, hearing aid status.

SUBJECT SELECTION CRITERIA:

It was to select fluent speakers with ah range of 18 to 75 years with bilateral mild to severe sensorineural hearing loss irrespective of gender, subjects with middle ear pathologies and Individuals with unilateral hearing impairment were not included in the study because their handicap might vary depending on the status of the normal ear. Individuals with be full term, half term, retired or no working status were taken in the study.

PROCEDURE

Questionnaire developed by Jack A. Holman (2019), University of Nottingham, Glasgow, UK. This questionnaire was found reliable to get individualistic broader patient perceptive approach. The procedure primarily involves collecting of the participants demographic data taken from various speech and hearing clinics which includes participant’s name, age, gender, address, Degree of hearing loss, type of hearing aids and duration of hearing aid usage. Secondly, the participants were provided with questionnaire and was administered on them to find out impact of hearing impairment on everyday life in post lingual hearing impaired adults and answers were noted down at the same time in conversational language to avoid bias of clinicians vocabulary.

STATISTICAL ANALYSIS

- Detailed reading and running of text analytics on the data was done.
- To validate the responses Z test was done on the data dividing data into two parts, as of questionnaire.

Age		
Age Group	Frequency	Percent%
<= 30	2	6
31 – 40	6	20
41 – 50	10	33
51 – 60	6	20
61 – 70	3	10
71+	3	10
Total	30	100

The above table indicates age group respondents

The oldest respondent (AGE 74) has to say the following:

The oldest respondent having the hearing problem since his 21 years and was progressive, He has been using the Hearing aids for the past 12 years , feels that hearing impairment is causing lot of difficulty in executing the day to day activities. The respondent as well is of the opinion that hearing aid is not of great help , he has lot of stress and fatigue due to hearing loss and the hearing aids. He is of the opinion that the hearing aids are not good for wearing.

Middle aged respondents have expressed that they have severe difficulty with the hearing impairment in comparison to younger ones.

P 23

I have hearing loss since eight years. I am unable to speak to anyone due to this. I cannot bear this silent world running around where everyone is talking smiling laughing I cannot have all these with my loved ones. I lost my job due to this , then I got new job but I am struggling a lot their also.

P 07

I have hearing loss since seven years , I got hearing loss due to the the noise exposure in my company , I am ground engineer in aurobindo , due to hearing loss people started ignoring me , I started feeling alienated in almost all gathering.

The youngest respondent (AGE 25), has the following to say,

Has been suffering from Hearing loss since young age, got adjusted with and comfortable with Hearing aids, no much stress, with the hearing aids, but after taking out the hearing aids relief.

Old aged respondents have expressed that they have severe difficulty with the hearing impairment in comparison to younger ones but in comparison to other age group persons these have got used to with hearing impairment and hearing aids.

BASED ON TEXT ANALYTICS: From the responses of the respondents, patients should take listening breaks from hearing for some time to bounce back energetically, sophisticated hearing aids and being better programmed will help the hearing impaired persons. Responses of 30 respondents is considered to generalize the findings to the population and data is processed, and the sample results of the sample can be attributed to the population.

Parts	Z Score value	Z (cal)	Indications
Part 1	1.645	5.96	Since Zcal is greater, it can be concluded that Hearing Impairment is causing Fatigue in professional and personal life.
Part 2	1.645	1.11	Since Zcal is not greater, it suggests that use of Hearing Aids not causing Fatigue in professional and personal life.

Hence it can be also described that use of Hearing Aids not all benefitted in solving hearing related fatigue. Some respondents also felt and stated that programming and highly sophisticated and many featured hearing aids can be beneficial.

Based on the Z tests, one can conclude that in the population the persons with hearing impairment Likely to face lot of stress and it might cause Fatigue and strain. Patients should take breaks from hearing for some time to cope up at work, hearing aids being better programmed will help the hearing impaired persons.

People with severe hearing loss can have listening breaks during the heavy (busy) working day.

CLINICAL IMPLICATIONS:

The study provides documentation regarding the reasons for non regular use of hearing aid due to fatigue. The following clinical implications can be derived from the present study which may be useful for audiologist and hearing aid manufacturers especially when considering trail and fitting for adult hearing impaired, the finding of the study have clinical implications for audiological practice. This information is critical for audiologist during programming hearing aids and prescribing better appropriate hearing aids. This information is also can be used by professional in understanding fatigue with hearing impairment on patients perspective. Clinicians can also suggest listening breaks for patients according to the level of strain and fatigue patients are complaining about.

LIMITATIONS

Purposeful sampling was intended to include participants who differed widely with respect to age, hearing aids status, occupational status and levels of hearing loss. Study was conducted with Small sample size results are hard to generalize. Likewise, participants with a more profound hearing loss might also have exhibited a more pronounced effect of fatigue.

FUTURE SUGGESTIONS

More research is needed for generalization.

Future research is needed to investigate the fatigue associated with specific listening activities, and how hearing-related fatigue is impacted by an individual's motivation to engage in given situations. Additionally, given that the extent of fatigue attributable to hearing impairment varies widely amongst people, more research is needed to investigate the impact hearing aid fitting has on fatigue.

CONCLUSION

Majority of the respondents indicated that the hearing loss caused them with difficulties at professional and personal front, they could not lead the life of a Normal Individual. The Hearing Aids gave them the required support to lead relatively normal life, but to some extent only. The hearing Impairment caused lot of Fatigue and Tiredness to most of the patients but not all, The hearing aids caused inconvenience but to some extent reduced the Fatigue and Fatigue related issues.

This is unique study of its kind to offer direct insight into the daily-life fatigue experienced by people with a hearing impairment. The findings indicate that fatigue is an issue experienced by many, but not all, people with a hearing impairment. There is a strong emotion-driven aspect to fatigue in addition to the more commonly discussed strain and tiredness. There is widespread utilization of coping strategies by individuals to mitigate the impact of hearing impairment.

Some strategies are utilized purposely to reduce fatigue and effort, whilst some strategies are undertaken automatically with limited insight into how they impact on fatigue and listening effort.

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