Original Research Article

Co-relation of audiometric configurations and auditory difficulties in adults with acquired sensori-neural hearing loss

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Abstract

Introduction: Hearing impairment is one of the most common handicapping problems in this country. There are millions of individuals in this country with varying degrees and types of hearing impairment including children, adults and elders. Hearing is important for speech and language development. Even minor degrees of hearing impairment, especially pre-lingual can affect overall development.

Aim: To correlate the different audiogram configurations in adults with acquired sensori-neural hearing loss with the self reported auditory difficulties (which rules out biased reports).

Materials and methods: The research design was exploratory and the sampling was purposive. The sampling selection was prospective. All the subjects we selected were according to the following criteria. Inclusion criteria were *t*he patients selected should have minimum 3 years of sensori-neural hearing loss, age range was between 18 to 60 years, pure-tone average (500, 1000 and 2000 Hz) hearing loss was > 25 dB HL and <70 dB.

Results: Audiogram Pattern wereFlat Pattern, Gradual Sloping, Sharply sloping, Precipitously sloping.

Conclusion: Irrespective of audiogram configurations speech intelligibility in noise is most severely affected and discrimination of sound is least severely affected. The patients with similar looking audiograms had similar perception of auditory difficulties (Flat and gradual sloping patterns had similar difficulties. Trough/ saucer and notch also had similar auditory difficulties).

Key words

Audiometric configuration, Auditory difficulties, Sensori-neural hearing loss.

Introduction

Hearing impairment is one of the most common handicapping problems in this country. There are millions of individuals in this country with varying degrees and types of hearing impairment including children, adults and elders. Hearing is important for speech and language development. Even minor degrees of hearing impairment, especially pre-lingual can affect overall development [1, 2].

A person's ability to communicate depends on the sensory (hearing) and non-sensory factors like general communication skills, emotional aspects and the behaviour of family members, friends and co-workers [3-5]. The commonest way used to measure the individuals hearing threshold is using pure tone audiometry which gives the type of hearing loss, degree of hearing loss and configurations of the hearing loss. The audiometric tests don't assess the non-sensory variables that contribute to communication [6].

The most common complaint of the patients with sensori-nueral hearing loss is difficulty in understanding speech in situations with background noise. The ability to understand speech in noise is poorly predicted by pure tone thresholds. Therefore two more approaches are used for the measurement of hearing impairment. They are functional tests (speech in noise) and self-assessment questionnaires [7-10].

Self assessment questionnaire

The auditory rehabilitation purely based on the audiometric findings is a failure, because it provides only sensory information. The non-sensory factors are assessed by Self assessment questionnaire e.g. HHI (E) and (m) AIAD [11, 12].

Audiometric configurations

There are different types of audiometric configuration of hearing loss associated with different pathologies. Audiometric configurations can be useful in describing individuals hearing for research, clinical work and for explaining the findings to the patient [13]. For the current study, classification of audiometric configurations given in "Hand book of clinical audiology" (5th edition), edited by Jack Katz and published by Lippincott Williams and Wilkins company in the year of 2002, was adopted [14] as per **Table - 1**.

Table – 1: Classification of audiometric configuration.

Term	Description
Flat	≤ 5 dB average difference/ octave
Gradual Sloping	6-10 dB rise or fall/octave
Sharply Sloping	11-15 dB rise or fall/octave
Precipitously sloping	≥ 16 dB/ octave
Rising	Better hearing /octave
Trough or saucer	≥ 20 dB more loss at middle
Notch	Sharply poorer at one frequency with recovery at the adjacent frequencies

A poor correlation exists between hearing problems and pure tone audiometry has been reported in a population based study in the UK [15].

Need for the study

There are only few population based epidemiological studies on audiogram configurations among adults. Most of the studies are from the western countries. Collecting audiometric configuration data and linking it with self perceived auditory difficulties would be useful in audilogical management.

Aim of the study

- To correlate the different audiogram configurations in adults with acquired sensori-neural hearing loss with the self

reported auditory difficulties (which rules out biased reports).

Materials and methods

The research design was exploratory and the sampling was purposive. The sampling selection was prospective. All the subjects we selected were according to the following criteria.

Inclusion criteria

- The patients selected should have minimum 3 years of sensori-neural hearing loss.
- Age range was between 18 to 60 years.
- Pure-tone average (500, 1000 and 2000 Hz) hearing loss was > 25 dB HL and <70 dB.

Exclusion criteria

- Pure tone average (500, 1000 and 2000 Hz) hearing loss <25 dB and >70 dB.
- Conductive or mixed hearing loss.
- Any cognitive or neurological impairment.

Test Equipment

- Pure tone audiometer with standard supra-aural ear phones and bone conduction vibrator calibrated as per ANSI (S3.6-2004) standard.
- An immittance audiometer to rule out any conductive pathology.

Procedures

- Consent for participation in the study was taken.
- Demographic details with detailed case history were taken.
- Otoscopic examination and immittance testing were done.
- Pure tone audiometry with air and bone conduction threshold was done.

Audiograms were classified based on the system into flat, gradual sloping, sharply sloping, precipitously sloping, rising, trough and saucer [16-20].

In the proposed study the modified Amsterdam Inventory for Auditory Disability and Handicap (mAIAD) given by Meijer et al 2003 was used. The AIAD was originally developed by Kramer, et al. (1995). The mAIAD consist of 28 questions under 5 categories [21].

The respondent was asked to judge how he/she experienced auditory difficulties (detection of sound, discrimination of sound, auditory localization, intelligibility in noise and intelligibility in quiet) in the mentioned situation without any amplification devices. The answered categories were– almost never, occasionally, frequently and almost always [22-29].

Ethical Considerations

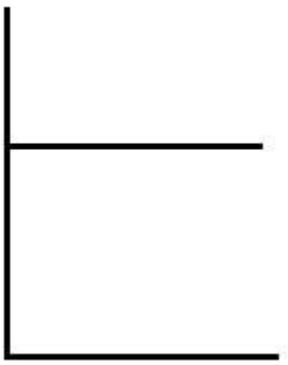
- All guidelines for conducting research on human subjects were followed.
- The procedure done did not involve any invasive technique.
- Informed consent was taken from all the participants before enrolling them in the study.

Results and Discussion

Audiogram patterns were mentioned as below.
Auditory difficulties from severe to lesser

Flat pattern

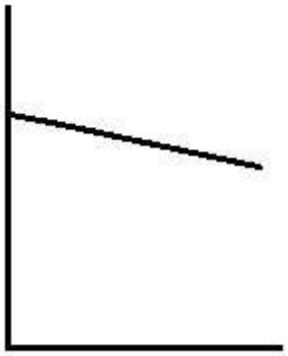
- Intelligibility in noise
- Intelligibility in quiet
- Detection of sound
- Auditory localisation
- Discrimination of sound



Gradual sloping

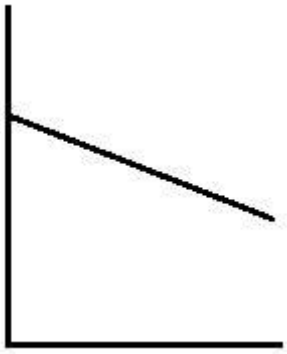
- Intelligibility in noise
- Intelligibility in quiet

- Detection of sound
- Auditory localisation
- Discrimination of sound



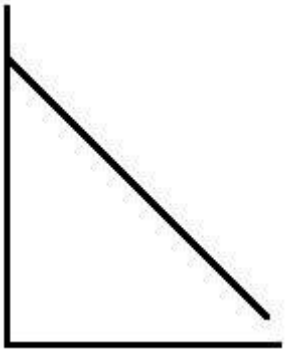
Sharply sloping

- Intelligibility in noise
- Detection of sound
- Intelligibility in quiet
- Auditory localisation
- Discrimination of sound



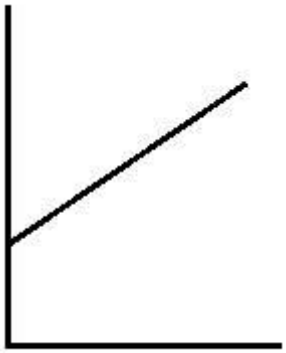
Precipitously sloping

- Intelligibility in noise
- Detection of sound
- Intelligibility in quiet
- Auditory localisation
- Discrimination of sound



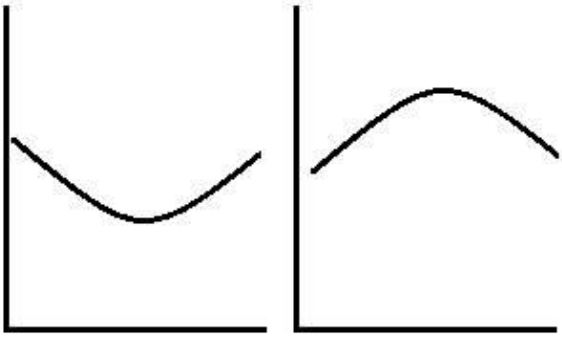
Rising pattern

- Intelligibility in noise
- Intelligibility in quiet
- Detection of sound
- Auditory localisation
- Discrimination of sound



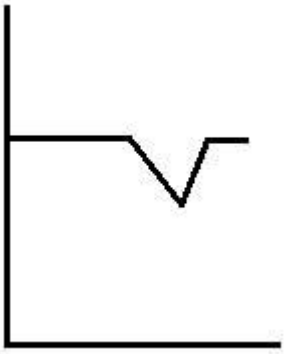
Trough - Saucer Pattern

- Intelligibility in noise
- Intelligibility in quiet
- Detection of sound
- Auditory localisation
- Discrimination of sound



Notch Pattern

- Intelligibility in noise
- Intelligibility in quiet
- Detection of sound
- Auditory localisation
- Discrimination of sound



The most prevalent audiometric configurations were flat (40.70) and gradual sloping (31.8),

followed by sharply sloping (9.7), trough/ saucer (5.93), precipitously sloping (4.58), notch (4) and rising (3.23) as per **Table - 2**.

Table – 2: Prevalence of audiometric configuration.

Audiogram configuration	Percentage
Flat	40.70%
Gradual sloping	31.8
Sharply sloping	9.7
Trough/ Saucer	5.93
Precipitously sloping	4.58
Notch	4
Rising	3.23

Conclusion

- Irrespective of audiogram configurations speech intelligibility in noise is most severely affected and discrimination of sound is least severely affected.
- The patients with similar looking audiograms had similar perception of auditory difficulties (Flat and gradual sloping patterns had similar difficulties. Trough/ saucer and notch also had similar auditory difficulties)
- Different looking audiograms (precipitously sloping and rising) had different difficulties.

Therefore the pure tone audiometry should be followed by self assessment questionnaire for better counselling as well as for further hearing management.

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