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Pilot Study to Evaluate the Prevalence of Hearing Loss in a Rural Community Using Dp Oae Screener

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Abstract

Hearing impairment is a leading cause of disease burden, yet population-based studies that measure hearing impairment are rare. In a developing country where most of the population live in rural areas this disability causes educational and emotional disability in children and economic and social disability in adults. A Pilot study was conducted for screening for hearing loss in a rural community using Dp OAE screener. A total number of 1117 rural and tribal populations between age groups of 6 months to 70 years were screened. Pure tone audiometry was done simultaneously. It was found that the prevalence of hearing loss in the community does not correlate with the symptoms expressed by the population with 63.31% failing the test (refer) which was confirmed by Pure Tone Audiometry. It was found that among patients with "refer" there was disabling hearing loss in adults (>80%; 40dB HL and above).This model envisages the use of Oto acoustic emissions which are sensitive to both sensorineural and conductive hearing loss, to be an cost effective screening tool in a rural community.

Keywords DpOAE; Hearing loss; Pure tone audiometry; Community screening; Population studies

Introduction

There are 360 million persons in the world with disabling hearing loss (5.3% of the world's population) and 32 (9%) million of these are children [1] and the estimated prevalence is 6.3% in Indian population, yet population-based studies that measure hearing impairment are rare. The most commonly used model to date has been a hospital based screen employing a team of dedicated screeners measuring otoacoustic emissions (OAE) in neonates in the maternity unit before discharge and using audiometry and various questionnaires in combination for adults [2]. In a survey of the current status of Neonatal hearing screening program in India it was found to be less than adequate and there was a problem of following up identified children [3,4]. In a developing country where most of the population live in rural areas , due to the stigma and traditional practices this disability is neglected leading to educational, emotional trauma in children and economic disability in adults in addition to being discriminated. Thus the need of the study arose to use a sensitive hearing screening device which can be operated by anyone and is accurate in a rural community with low literacy rates and awareness.

Oto-acoustic emissions (OAEs) can be defined as the audio frequency energy which originates in and is released from the cochlea, transmitted through the ossicular chain and tympanic membrane and measured in the external auditory meatus. They can occur either spontaneous or in response to acoustic stimulation. Oto-acoustic emissions are vulnerable to a variety of agents such as acoustic trauma [5], hypoxia [6] and oto-toxic medication [7] that cause hearing loss by damaging outer hair cells. Taking into account estimates of amplification provided by outer hair cells, complete destruction of OHC'S alone could result theoretically, in a hearing loss of 60 dB. Early investigations in to OAE'S proved that they are not present when the sensorineural hearing loss exceeds 40-50 dB. It has been established that DPOAEs are reduced or eliminated by compromise of middle ear conduction pathway and can also be used to confirm the presence of any middle ear pathology. OAEs only occur in a normal cochlea and if hearing is at least 30 dB or better. Otoacoustic emissions are never found when hearing loss at 1000 Hz exceeds 40 dB hearing level and when the mean audiometric hearing loss (at 500, 1000, 2000 and 4000 Hz) exceeds 45 dB hearing level [8,9]. DPOAEs measures have shown excellent intra-subject test reliability which allows monitoring of dynamic changes of cochlear function [10]. Because OAE are sensitive to both sensorineural and conductive hearing loss, they were found to have the potential to be an effective screening tool across all populations, including children [11]. Sensitivity and specificity of OAE testing for hearing impairment ranges from 76.9-98% and 90% respectively [12-14]. The test procedure typically takes less than 2 minutes for both ears. It is non-invasive and does not require sedation for the patient. In order to PASS, OAEs must be present and be at least 5 dB above the background noise at 3 out of 4 frequencies. The Ero-ScanTM noise rejection algorithm is the most effective allowing for reliable testing in up to 70 dBSPL of background noise [15].

Aim

To identify Hearing loss in the community Using Portable Dp OAE SCREENER.

Methodology

This study was conducted in the rural and tribal areas of Vellore district where most are labourers living in quiet environments and lack of noise pollution.

Inclusion criteria

All residents aged 6 months and above.

Exclusion criteria

Meatal atresia, anomalies of external ear where probe insertion was not possible. Otitis media, otitis externa, discharge and wax in external auditory canal.

Christian medical college, Vellore Institutional Review Board (IRB) gave approval for the study.

A door to door survey of population was done in rural areas and tribal areas of Jawadhu hills in Vellore District. The team comprised of ENT specialist, audiologist and community workers. An informed consent (Tamil) was taken and the procedure was explained. A brief questionnaire was filled up by the community workers. The community workers were trained to operate Maico-ero scan DpOAE instrument. Screening for hearing loss was done in the community in an area where the noise level was <60 dB (verified by Noise level meter) after evaluation by ENT specialist. Pure tone audiometry was simultaneously done by the audiologist by a portable audiometer. A Screening DPOAE with fixed protocol (4 s) with Frequencies: 2–5 kHz was followed with an Intensity: 65/55 dB with a sound noise ratio of 6 dB the criteria for pass was: 3 out of 4 frequencies .Results were referred as "Pass"/"Refer". Refer patients (Adults) were further evaluated in the community by Pure tone Audiometry. Children (<16 years) were referred to tertiary centre for further evaluation.

Initially a pilot study was undertaken to compare the results of using the OAE SCREENER in the community and in a audiometric booth which were similar.

Classification

1. Group A–6 months to 3 years (Children at home)
2. Group B–3-5 years (Pre-school)
3. Group C–5-16 years (School)
4. Group D–Above 16 Years (Adults)

Statistical methods

All the data was entered into Microsoft excel format and SPSS software. Prevalence and age associated hearing loss was analysed using chi-square statistics. The sample size was calculated assuming an average prevalence rate of 10% [16].

Results

In our study a total number of 1117 were screened over a period of six months in both tribal areas and rural areas around Vellore district. 50.6% were females. From the brief questionnaire symptoms of hearing loss were reported by 3 (<16 years) and 34 (>16 years) persons respectively. The most common findings were chronic suppurative otitis media (36), wax completely occluding was seen in 16 persons and acute otitis media was seen in 13 persons. There was almost similar prevalence among Rural and tribal population (Rural 40.8%; Tribal 48.8%). Male to female prevalence was also similar. Hearing loss was mostly bilateral (Table-1).

Prevalence of hearing loss: Figure 1 and Table 2

Group A–6 months to 3 years (Children at home): A total of 311(n) children were screened for hearing loss. Acute otitis media was seen in 2 children. DpOAE could not be done in two children.

Pass score was obtained in 281 (90.9%).

Group B–3-5 years (Pre-school): A total of 38(n) children were screened of which 4 (1%) were "refer".

Group C–5-16 years (School): A total of 280(n) children were screened of which 62 (22.14%) had "refer". This group are being evaluated at the tertiary care centre.

Group D–Above 16 years (Adults): A total of 488(n) persons were screened of which refer was found in 309 (63.31%).

Hearing Loss In % age		Pearsons Chi Square	p Value
Rural-40.87	Tribal-48.82	2.817	0.093
Male-40.17	Female-44.58	1.74	0.187

Table 1: Prevalence of hearing loss.

	GROUP A (6 months to 3 years)	Group B 3-5 years	Group C 5-16 years	Group D above 16 years
"Refer"	29	4	62	309

Table 2: Patients who failed the Dp OAE test.

Pure tone audiometry revealed hearing loss in 42.4% in "refer" and in 16% (70) who "passed" the test.Moderate hearing loss in 46.3%, Moderately severe in 30.9%, severe in 17.8% and profound in 5% was found in the patients (Figure 2).

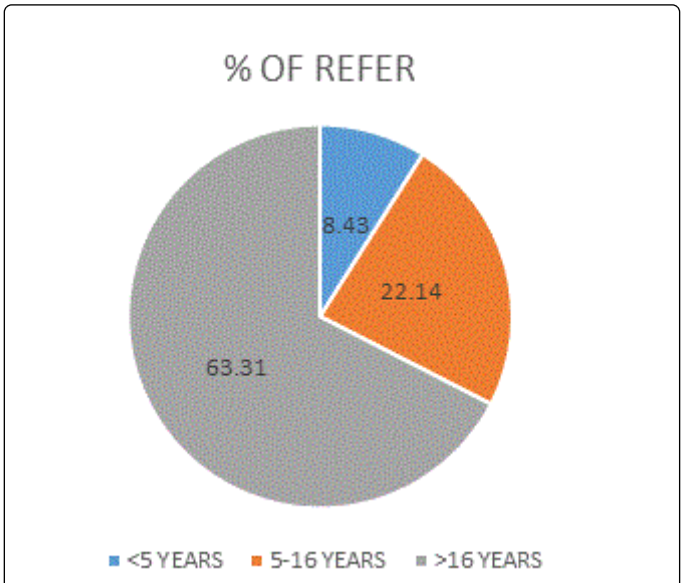

Figure 1: Pie Chart showing the results obtained with Dp OAE screener.

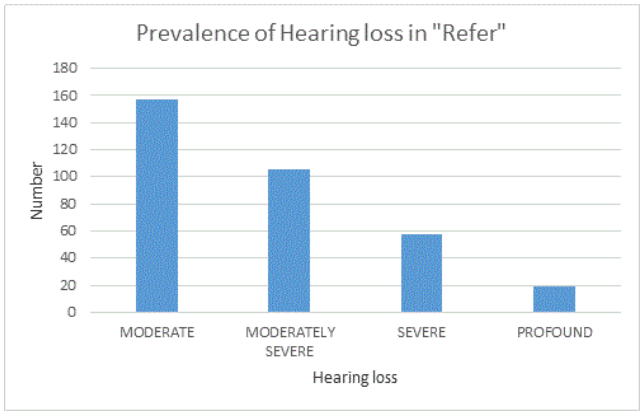

Figure 2: Classification by hearing loss.

Discussion

A review of literature revealed few population based studies in the Asia. Even though neonatal hearing screening is becoming mandatory, there are no comprehensive programmes for screening of children and adults. In this study 63.31% failed the test and among them more than 80% adults had disabling hearing loss (Moderate and above) which was confirmed by Pure Tone Audiometry.

Hearing loss is a significant problem which goes undetected and unrecognized because of the lack of awareness about the rehabilitative options available. People do not find it to interfere with their daily life because of lack of noise pollution and quiet environments they live in. Thus the exact prevalence of hearing loss is not known. This was also demonstrated in the study as the prevalence of hearing loss in the community does not correlate with the symptoms expressed by the population The use of trained community workers using an OAE screener which is non-invasive, does not depend on the subjects response (Pure tone Audiometry) gives us a definitive picture of the prevalence of this disability in the community and is better than questionnaire methods in a developing country where majority of people live in rural and tribal regions.

Conclusion

This study demonstrates the need for hearing screening at primary level in a rural community. Early detection of hearing loss is a cost effective and easily operable model is the need of the hour. Oto-acoustic emission testing is one which is easy to use reliable and can be used to screen large numbers. This model of identifying hearing loss using an OAE screener will lead to further evaluation and management at an early stage and can be implemented in developing and low income countries.

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