

# Universal Newborn Hearing Screening



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**Abbreviations:** ABR: Auditory Brainstem Response Testing; OAE: Oto Acoustic Emission Detection

## Introduction

Universal New-born Hearing Screening is the screening test of hearing of all neonates it is considered today a standard care in developed countries. The difficulties in the past were related to delayed diagnosis of hearing loss in children due to limitations in techniques and equipments used for diagnosis of deafness which unfortunately happened to be too late to be useful in most instances. The advanced understanding and innovations in the field of medicine have entirely changed the ways and means of early identification of deafness, from the primitive and simple clap in front of the child and noting his response of blinking to the standard hearing assessment tests of Auditory Brainstem Response testing (ABR) and the more recent Oto Acoustic Emission detection (OAE). The application of ABR and OAE has totally changed the scenario. Today it is possible to test a child's hearing reliably at birth itself even at a mass screening level.

## Is Your Newborn Hearing?

The prevalence of hearing loss in new-borns is quite high. Statistics from the US shows that the number of infants born with hearing loss ranges from 1 per 1000 live births to 6 per 1000 live births with an average prevalence of mild or greater congenital sensorineural hearing loss of 3 to 4 per 1000 live births. Out of the nearly 4 million infants born in the US each year, approximately 4,000 are born profoundly deaf and about 37,000 are born with milder hearing impairments every day, 33 babies (or 12,000 each year) are born in the United States with permanent hearing loss with 3 of every 1,000 new-borns having a hearing loss, it is the most frequently occurring birth defect [1].

## Magnitude of the Problem Is Quite High

Deafness is the cruelest form of sensory deprivation and is a catastrophe that affects every aspect of the victim's life. Deafness

can be one of the most difficult, lonely, and misunderstood disabilities. Hearing is perhaps the most important sense, for without it the power to communicate is greatly diminished. It is after all, this unique ability to communicate that sets human beings superior to all other animals. A child born with such a degree of deafness so as to prevent him of ordinary speech perception is destined to mutism. While hearing loss can affect a child's ability to develop language and words [2].

## The Socioeconomic Impact

The report on national public health goals, for the year 2000 in USA concluded "Disability due to hearing impairment is far reaching and can affect many aspects of life [3]." What it means to all the health care providers and governments. Lifetime costs of each case of congenital deafness have been estimated at over \$1 million and programmes and services for the communicatively handicapped are estimated to cost \$23.4 billion per year in the US. The cost of not identifying hearing impairment in one person may reach \$1 million in the US [4]. The unsympathetic attitude with which a deaf person is greeted (unlike blindness) because it is an invisible handicap can cause more distress and despair. The personal and social impacts of hearing loss are profound. The deaf person is taken for provoked ridicule because he is unable to respond to what he told, his control of voice is not according to the command tone and there comes ultimately a feeling of helplessness and ignorance. It is an unhealthy attitude of society to the otherwise healthy and wise deaf.

## To Be Able to Speak One Must First Be Able to Hear

Hearing loss becomes more when it comes to a child born deaf. A child born deaf cannot learn to speak without special help. Normal language development will be impossible. For a child with a hearing loss, the biggest challenge is learning to communicate.

It is more difficult to learn to speak because there is no feed in, of vocabulary of words which can lead to frequent disappointments and misunderstandings, it is no surprise, that children with hearing loss sometimes are slow in learning to relate to other people, feel lonely or forgotten, or develop behaviour problems [5].

## Newborn Hearing Screening Is the Current Trend in The Early Diagnosis of Deafness

Universal Newborn Hearing screening is now considered a standard care in developed countries. In today's world of glamour quality of life plays a major role. This understanding has brought the aim to recognise every deaf child as early as birth itself so as to enable any medical or surgical cause needing treatment to be instituted before the vital time for learning speech is wasted. This is because any mild hearing loss during this period can seriously reduce a child's word learning potential. Speech is acquired by imitation. There is a period during natural development, when speech is more readily acquired. After the age of two years, it becomes progressively more difficult to acquire speech because by the age of two in the average normal hearing child a good vocabulary and the capacity to string words together into simple sentences has already been acquired.

The understanding that the first year of life is the period of readiness for listening and the second year a period of readiness for speaking has brought a lot of significance to early detection of hearing loss and early correction or aid in the form of speech amplification and special education of Auditory training. This helps the child to reproduce the spoken words during the vital period of development of language build up, in which cortical activities increases and comprehension, discrimination, augmentation and power of attention, observation and memory are developed. It is therefore certain that early diagnosis and early auditory training is mandatory to avoid this handicap. It is this auditory training that brings the hearing compromised child from the confusing and lonely environment of unintelligible sound to the world of understanding of speech and language [6].

## Latest Technology Has Changed the Sceniaro

Today we live in a world of glamour and quality of life. Today a person does not want to merely live. This concept has given way to the issues of quality of life. New technological advances in the fields of audiology have made it possible to test a child's hearing reliably at any age after birth, even just after birth and that too at a mass screening level. This is Universal newborn hearing screening. Introduction of Evoked Oto acoustic Emission device has enabled screening of the newborn at mass scale. Universal newborn hearing screening has better language outcomes for children born in areas of the country or during years in which Universal newborn hearing screening had been implemented compared with cohorts of children born before universal newborn hearing screening [7].

## Oto Acoustic Emissions (OAE)

Few years ago, such facility was not existent. It is based on knowing the fact that when the cochlea is subjected to sound waves it is stimulated to produce an emission of sound generated within the cochlea. This can be detected and recorded and is now being used as a screening test of hearing in newborns. Assessment of hearing has been innovated to this extent quite recently. Although the traditional conversational voice test supported by Tuning Fork test, Otoscopy, Pure Tone Audiometry, Tympanometry and the Brain Stem evoke response Audiometry Bera are all useful tools and fruitful search for the cause, together with no replacement of clinical history, but all these are helpful when the intervention is too late.

OAE test records sounds produced by inner ear in response to sound signals.

The term OAE test describes releases of acoustic energy from the cochlea recorded in the external ear. Sir Kemp (1978) discovered that low intensity sound energy, generated by the cochlea could be recorded in the ear canal. He termed these phenomenon Oto acoustic emissions. These measurements are now used in audiology and they have found application in neonatal hearing screening programmes. It is agreed that Oto acoustic emissions are generated only in a healthy cochlea and that their presence indicates mechanically active outer hair cells. The technique is ideal for neonatal screening because it is non-invasive. It can be undertaken during sleep, requiring only the insertion of an ear probe (similar to impedance probe).

Evoked Oto acoustic emissions are absent when the hearing loss is greater than 30dB. The technique is objective and gives specific information of cochlear function. However, it should be remembered that it gives no indication of hearing threshold except that when present the hearing is near normal. OAE are very useful and accurate objective tests for early detection of hearing loss, even at birth. The sensitivity (97-100 %) and specificity (86-96%) However OAE is much simpler to perform and analyse, non-invasive and cheaper, even though OAE gives no indication of the degree of hearing loss it has emerged as a good screening test which can be used on a mass scale for universal screening of hearing of newborn. It can also be undertaken during sleep, requiring only the insertion of an ear probe. Many countries use a screening in which all neonates are tested in the first stage by OAE and neonates who fail to pass OAE in the first stage are subjected to ABR in the second stage, which effectively optimizes the cost factor.

Keeping this in view the need for screening of hearing of neonates, to detect hearing loss at the earliest age in certain high-risk groups may be significant like any child who has a family history with a hearing loss in early childhood or who is born to a mother who has German measles, toxoplasmosis or Herpes simplex or infection during pregnancy. Furthermore, any child

who weighed 1.8kg or less at birth or with low Apgar scores or unusual ear, eye, head and neck development or had meningitis or any other perinatal infection. The high-risk factors should also be considered like consanguinity, high number of premature babies, high incidence of congenital anomalies and genetic disorders. Universal Newborn Hearing Screening has become the state of art in present times.

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