AN AUDIO VISUAL ON AUDIOLOGICAL EVALUATION FOR THE YOUNG INITIATED

Reg.No.M9207

AN INDEPENDENT PROJECT IN PART FULFILMENT FOR THE FIRST YEAR M.Sc. (SPEECH & HEARING) SUBMITTED TO THE UNIVERSITY OF MYSORE.

ALL INDIA INSTITUTE OF SPEECH AND HEARING: MYSORE - 57O OO6.

MAY 1993

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CERTIFICATE

This is to certify that the Independent Project entitled: An Audio visual on Audioloaical Evaluation For The Young Initiated is the bonafide work in part fulfilment for M.Sc.,(Speech & Hearing) of the student with Reg.No.M92O7.

Mysore
May 1993

Director
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CERTIFICATE

This is to certify that the Independent Project entitled: AN AUDIO VISUAL ON AUDIOLOGICAL EVALUATION FOR THE YOUNG INITIATED has been prepared under my supervision and guidance.

Mysore
May 1993

Dr. (Miss) S.Nikam,
GUIDE

DECLARATION

I hereby declare that this Independent Project entitled} AN AUDIO VISUAL ON AUDIO-LOGICAL EVALUATION FOR THE YOUNG INITIATED is the result of my own study under the guidance of Dr. (Miss) S.Nikam, Prof. & Head of the Department of Audiology and Director, All India Institute of Speech and Hearing, Mysore, has not been submitted earlier to any University for any other Diploma or Degree.

Mysore

May 1993 Reg.No.M9207.

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INTRODUCTION

"Audiology" refers to the study of hearing and hearing disorders. The word "Audiology" is derived from the Latin words "audire" which means to *hear' and ' logy' which means the "scientific study of". The field of Audiology is a broad one to which varied specialists contribute their knowledge and skill. An "Audiologist" is an individual concerned with the identification and measurement of hearing loss and the rehabilitation of those with hearing-impairments.

Audiology is the offspring of two parent fields speech pathology and otology. Speech pathology deals with the diagnosis and treatment of individuals who suffer from disorders in oral language. Otology is concerned with the diagnosis and treatment of individuals who have an ear discharge or disorders of the peripheral mechanism of hearing.

The term "audiometry" originally meant only the measurement of the auditory threshold for pure tones. This restricted meaning was gradually extended as different techniques of auditory measurement were developed. The field of audiometry now includes pure tone audiometry, speech audiometry, screening audiometry, group audiometry and recently automatic audiometry.

Audiometry may be divided into two broad subfields on the basis of the type of stimulus used to elicit auditory responses; pure tone audiometry and speech audiometry. Pure tone audiometry is used primarily to determine air conduction and bone-conduction thresholds of hearing. These thresholds are necessary for diagnostic evaluations of hearing loss. Pure tone air-conduction tests and pure-tone screening tests are also used extensively in industrial and school hearing conservation programs. Speech audiometry is used principally to obtain speechreception thresholds and speech discrimination scores for diagnostic purposes and to evaluate the performance of hearing aids.

In 1875 Alexander Graham Bell first introduced the electric telephone. The principle of the telephone was rapidly applied to the problem of hearing tests. By 1878, Hartmann, an Otolaryngologist reported that he had devised an "acoumeter", which utilized a telephone receiver for the purpose of testing hearing. A tuning fork was placed in the primary circuit of an induction coil, interrupting the circuit at regular intervals. The interruptions induced an alternating current in the secondary circuit of which the telephone receiver was a part. The receiver reproduced a tone corresponding to that of the vibrating tuning fork, regulated in intensity by a rheocord, or sliding inductance.

Hartmann's acoumeter and the several variations that followed in the next thirty five years were not in general clinical use by otologists. The early instruments were bulky and difficult to keep in running order. Moreover, they were limited in their diagnostic scope: only tuning forks with a frequency of 1000 c/s or less could be used effectively, and the output intensity had no psychophysical referent. It told nothing about the hearing for speech and was therefore limited in diagnostic value.

In 1879, Hughes in England described an "induction balance" originally used to analyze metals, but applied with a tuning fork to the test of hearing. He called this instrument an "electric sonometer", but it was this instrument that inspired the first use of the term "audiometer".

During the years that followed Hartmann's and Hughes's instrument, other devices were reported which used the induction coil to transform an interrupted direct current into an alternating current for producing pure tones. None of these early variations was able to apply exact psychophysical measurements to the entire range of human hearing.

In 1914 Stefanini of Italy constructed an instrument which made the modern audiometer possible. This was an electric

generator producing an alternating current with a complete range of frequencies. An iron-toothed pendulum passed through an electromagnetic field, causing magnetic changes. An alternating current was thus produced In the generator with a frequency depending on the speed of the pendulum's, passing through the field. The distance which the pendulum fell governed the speed, and thus frequency, that was produced. This was an experimental instrument and was never applied clinically.

On the basis of Stefanini's principles, Deant, Head of the Department of Otolaryngology at the University of Iowa, and Bunch his research assistant, applied the electric generator to the first clinically useful "pitch range audiometer" in 1919. It was so called because it produced all the tones between 30 c/s and 10,000 c/s by means of a small alternating current generator driven" by a variable speed motor. The intensity of the tones could be varied from below the threshold of audibility upto the threshold of pain. Dean and Bunch's audiometer was never produced commercially, but the two inventors published several articles describing the clinical application and interpretation of their audiometric tests in otologic practice.

In 1921 the vacuum tube audiometer was reported by independent investigators Minton, Wilson and Guttman, Their instruments utilized the vacuum tube to obtain oscillating electric currents of almost any frequency desired. Although never commercialized, their instruments were prototypes of future commercial audiometers.

The principles of the first commercial clinical audiometer were presented in 1922 by the otologist Fowler and physicist Wegel, who reported on the use of the Western Electric 1A audiometer. This instrument had been developed by Wegel and his fellow physicist Harvey Fletcher for the Bell Telephone Laboratories and the Western Electric Company. Fowler and Wegel named the chart obtained from the threshold measurements an "audiogram".

Their audlogram was plotted on the logarithmic scale of intensity in terms of percentage of hearing. Percentage was calculated on the basis of range of hearing, from minimum audible threshold to threshold of feeling. The hundred percent line (normal hearing) was of the top abcissa; the zero percent (total loss) on the bottom; and the ordinate represented Bels. This audiogram looked somewhat like ours today. The hundred percent point representing the average normal hearing threshold was determined by a statistical study of normal ears.

The Western Electric 1A audiometer was never widely used, because of its cost, one thousand five hundred dollars in that time and also because it did not test the bone conduction values,

A less expensive model, the Western Electric 2A, soon succeeded the 1A and found its way into general use by Otologists. Unlike the 1A, which produced a sweep frequency output from 32 to 8192 ec/s, the 2A presented only the octave frequencies from 64 to 8192 c/s. A further model, the 3A used complex noise stimulus but never found favour among Otologists. Many years later, in 1950, the German Otologist Langenbeck started experiments with noise audiometry, using filtered bands of noise. He reported in 1962 on the successful use for diagnostic purposes of these critical bondwidths when used along with pure tones.

The use of a bone-conduction receiver in connection with the pure-tone audiometer was finally reported in 1924 by Jones and Knudsen. Their "audioamplifier" included not only air conduction and bone conduction but also a speech circuit. Another unique feature of Jones and Knudsen's audiometer was a masking noise source. Their noise apparatus consisted of an ordinary electric buzzer. This produced an interrupted

direct current in the coils of the telephone receiver, creating a loud noise in the receiver. Here is apparently the first recognition of the need to mask a good ear While testing the poorer one.

Jones and Knudsen's audio-amplifier was later modified and produced by the Sanatone Corporation as the Sanatone Jones-Knudsen Model 1 audiometer.

Hearing-impairment is a matter of degree of loss and also of pattern or type of loss. When a person complains that his hearing is defective, we need to know certain things about his hearing loss - information which, together with the person's medical history and results of the physical examination will enable the otologist to make a diagnosis of the type of hearing loss that the person has and gives a basis for estimating the possible effect on the loss of treating the case medically or surgically. For diagnosis and prognosis, the otologist needs to know:

(1) How much hearing loss is there in the low-middle and high frequency ranges of the ear?

(2) How does the patient's air conduction hearing compare with his bone conduction hearing?

(3) How seriously is the patient handicapped by his hearing loss?

To provide answers to these questions, otologists have devised various tests of patients' hearing ranging from the crude watch-tick and coin-click tests to the extensive quantitative measurements made possible by the development of pure-tone and speech audiometers. Between these extremes fall time honoured tests (used by otologists) such as the spoken - and whispered - voice test, and the various tuning fork tests. Even with today's modern audiornetric instrumentation available, many otologists prefer to diagnose and "measure" hearing loss by means of voice and tuning fork tests.

Watch-tick and coin click tests:

These tests would usually be administered by a general practitioner rather than by an otologist. The technique of administration is simple the physician holds his watch next to the patient's ear and asks the patient to inform him when he stops hearing the tick as the doctor moves the watch away. The physician must know the distance at which the person with normal hearing can just barely detect the tick. Hearing loss is expressed in terms of a fraction, of which the distance in inches that the patient can hear the watch tick is the numerator and the distance the normal ear can hear the tick is the denominator. Naturally, only the crudest information about the patient's hearing function is obtained from the watch tick test.

The coin-click test consists of the Physician's dropping a large coin, on a hard surface. The patient is instructed to say whether he hears the coin "ring" or only a dull thud. If he hears the coin ring, his high-frequency hearing acuity is normal. If he hears only a thud, he is presumed to have a high frequency hearing loss. This test gives no information about which frequencies are affected or the extent of loss. Also, it cannot be used successfully in testing one ear separately. Even with considerable clinical experience, therefore, results of the coin-click test are difficult to interpret meaningfully.

Neither the watch-tick nor the coin-click test are used today.

Conversational voice test:

When used by an experienced examiner aware of its limitations, it is useful in detecting gross deviations from normal hearing. The patient is placed at a prescribed distance from the examiner so that first one ear and then the other is directed toward the examiner. The patient plugs the ear not under test with his index finger. He is instructed to repeat the word he hears the examiner speaking. Then, in a "normal" level of voice, the examiner speaks some numbers.

simple words, and simple phrases. If the patient is unable to repeat these, the examiner moves toward the patient until he is able to repeat what the examiner is saying. A score of ten out of twenty means that the examiner had to move to a distance of ten feet from the patient before he was able to repeat what the "normal[11] ear is supposed to hear at twenty feet.

Tuning - fork tests:

In otology, the classic method of measuring, or describing hearing loss is by noting the patient's responses to vibrating tuning forks. Forks of various frequencies are selected for administering the standard tests. The most common fork tests are the Rinne, Weber and the Schwabach test.

The Rinne Test: The purpose of this test is to distinguish between conductive and perceptive hearing loss and thus assists the otologist in diagnosing the type of hearing-impairment that a particular patient shows. To perform the test, the otologist sets a tuning fork into vibration (by striking it against the elbow or sole of the shoe) and holds it close to the patient's external ear. When the patient

reports that he can no longer hear the sound produced by the fork, the otologist quickly places the handle of the vibrating fork against the patient's mastoid process and asks if the patient can still hear the fork. If the patient says yes, the result of this test is said to be a Rinne negative. Which indicates a conductive type of loss. If the patient hears the fork longer by air conduction than by bone conduction, the result is labeled a Rinne positive and indicates a sensori-neural loss. A Rinne test on a normal ear is positive, since normally our hearing is more sensitive by air conduction than bone conduction. Generally a tuning fork of 512 Hss is used.

The Weber Test: In this test also the purpose is to distinguish between conductive and sensori-neural hearing loss. This test is used only in cases of unilateral loss or in losses characterized by better hearing in one ear. It is a test of lateralization, that is, a test to see to which of the ears the tone is referred, or lateralized. When the handle of the fork is placed on the midline of the skull. If, when the fork is placed on the midline, the patient reports -that he hears the tone in his poorer ear or worse ear, a conductive loss is indicated. If he hears the tone in his better ear, the loss is sensorl-neural. If there is no difference in the sensitivity between the ears, the tone will be heard equally in the two ears.

The Schwabach Test; The Rinne and Weber tests are qualitative tests of hearing, that is they gave information about the type of loss the patient has. Schwabach test is a quantitative test; that is it tells how much loss a patient has. Like Weber test, it is a test of bone conduction. In performing the test, the examiner places the handle of a vibrating tuning fork on the mastoid of the patient and the patient has to say when he stops hearing the tone. As soon as the patient says that the tone is inaudible, the examiner places the handle of the fork on his own mastoid and counts the number of seconds he continues to hear the fork vibrate. This method presumes that the eeamlner has normal hearing. The results of the tests are expressed in terms of the time that the patient's hearing is diminished in comparison to the examiner's. Thus, if the examiner can hear the tone for ten seconds longer than the patient can, the test result is expressed as "diminished ten"• Since this is a test of bone conduction acuity, it measures the amount of sensori-neural loss present. Even with such "quantification" as this test provides, the test result is difficult to Interpret in terms of the amount of the pati eat' s loss, since units of time rather than loudness serve to express the loss. Nevertheless an experienced clinician can make effective use of this test to judge the severity of sensori-neural loss.

Test	Purpose	Placement of fok	Normal heating	Conductive loss	Sensori-neural loss
Schwabach	Compare patient' s bone conduction to normal	Mastoid process	Normal Schwabach patient's hear tone for as long as examiner.	Normal or pro-longed Schwabach patient hears tone as long as, or longer than examiner.	Diminished Schwabach patient hears tone for a shorter time than the examiner.
Rinne	Compare patient's bone conduction to air conduction	Alternately mastoid process & at ear opening.	Positive Rinne louder at ear	Negative Rinne louder behind ear.	Positive Rinne-louder at ear
Bing	Determine presence or absence of occlusion effect	Mastoid process	Positive Bing-tone sounds louder with ear opening occluded	Negative Bing Tone does not sound louder with ear open-ing occluded	Positive Bing-Tone sounds louder with ear opening occluded.
Weber	Determine conductive versus sensori-neural loss (in unilateral loss)	Midline of head	Tone heard equally in both ears	Tone louder in poorer ear	Tone louder in better ear

VISUAL	AUDIO
Patient and Audiologist :	Patient: Good morning. Is this the audlology department?
	Audiologist: Yes, please come in. What is your name?
	Patient: My name is Vinod.
	Audiologist: Okay, Vinod do you have a problem in hearing?
	Patient: Yes. I have been having a problem with hearing for quite some time now and I would like to get my hearing tested.
	Audiologist: Before testing your hearing, I want to ask you some questions. First of all, how old are you?
	Vinod: I am forty-five years old.
	Audiologist: Since how long have you been having this hearing problem?
	vinod: Since the last six months.
	Audiologlst: Do you get earaches or suffer from ear discharge?

Visual

Audio

: Vinod: No, earlier I did have ear discharge and ear pain but it stopped after using eardrops.

Audiologist: Can you hear better in one ear or is your hearing affected to the same extent in both ears?

Vinod: I feel both ears are affected but my right ear is slightly better than my left ear.

Audiologist: Okay, Vinod there are three important things that we need to find out:

1) Exactly how much is the hearing loss in your right and left ear?
2) What is the type of hearing problem you have?
3) What is the amount or degree of hearing loss?

Vinod: What is meant by type of hearing loss? Are there different types of hearing loss?

Audlologlst: Yes, there are basically three different types of hearing losses.

: 1) Conductive hearing loss
2) Sensori-neural hearing loss
3) Mixed hearing loss.
To understand these different types of hearing losses let me describe to you the various parts of the ear.

Audiologist points out the various parts of the ear from a model of the ear.

: The ear has three parts. An outer ear, a middle ear, and an inner ear. Whenever there is any damage or infection of the outer or middle ear, it can cause a conductive hearing loss. If there is damage to the inner ear or beyond the inner ear it can cause a sensor in eural hearing loss. If there is damage to both the inner ear as well as the middle ear it can cause a mixed hearing loss.

Vinod: Can you find out how much I hear in the right and in the left ear?

Audiologist: Yes, it is possible to find out or test your hearing

: separately in each ear by using these earphones, these earphones can be placed over each ear and a signal can be given separately to e ear.

Audiologist showing the earphones and showing how they are to be worn

Vinod : What is a signal?

Audiologist: A signal is a sound sent from/the earphones to the ear so that we can detect sound commonly used signals in testing are pure tone signals since they are easy to detect and help in estimating the degree of hearing loss, speech signals are also used to get an estimate of a person's hearing for speech.

Apart from your hearing probler do you have any other medical problem like diabetes or hyper-tension.

Vinod: No, I don't have any other medical problems.

: Audiologist: Did you ever have to take antibiotic drugs like streptomycin or kanamycin for any illness you might have had.

Vinod: No, I have never taken any of these medicines but I had taken pencillin for some tooth infection that I had. Can antibiotic drugs also cause a hearing loss?

Audlologist: Certain antibiotic drugs like streptomycin and kanamycin have been found to cause a hearing loss, especially when taken for longer durations and in larger doses. They were a frequent cause of hearing loss a few years back, but now similar drugs are available with less harmful side effects.

Do you work in a noisy environment, *for* example in a factory, where you would hear

: loud noises continuously for a long time? Or do you live in a noisy area? for example close to a railway line.

Vinod: No, both the place where I work, as well as the place where I stay, are quiet places. Do loud sounds also cause hearing problems?

Audiologist: Yes, if a person is exposed to loud sounds continuously and for long durations of time it can lead to a hearing loss as it causes damage to the sensitive structures of the inner ear. This could result in a temporary hearing loss where a person usually regains his normal hearing ability within forty-eight hours, or it could also cause a permanent hearing loss.

Vinod : Can you tell me the importance of these questions which you are asking me?

: Audiologist: These questions form the case history. In the case history pertinent identifying information for the case, such as home address and referral sources is obtained. Questions regarding the nature of past and present hearing problems, other medical problems and prior use of amplification are also usually included.

For children, more questions are asked, detailed questions about the mother's pregnancy and child's birth are included. The development of speech and language are also found out. The medical history of the child is reviewed in detail, with special emphasis on childhood diseases (measles, mumps, etc.)•

Gome let's start with the audiological evaluation.

Vinod: What is an audiological evaluation?

: Audlologist: An audiological evaluation involves testing a person 's hearing ability. This may be through pure tone audio-rnetry or through finding out a person's ability to detect speech, that is, speech aud iometry

Vinod: How is the testing done?

: Audiologist: Testing is done using this instrument which is known as an audiometer. Using this audiometer we can test a person 's hearing threshold for different frequencies, testing one ear at a time. We generally start testing lower frequencies first and then go on to higher frequencies. This dial is meant for adjusting the frequencies and this dial is meant for controlling the intensity.

Focus on the Danplex CA 92 audiometer

Audiologist showing the frequency and intensity dial

The subject is asked to raise his hand whenever he hears the

: sound and to but it down the moment the sound stops, even when he hears the sound very faintly he is asked to raise his hand. The lowest level at which he responses at each frequency is his hearing threshold for those frequencies.

Vinod: What is a hearing threshold?

Audiologist: Hearing threshold is the lowest (softest) sound level needed for a person to detect the presence of a signal approximately fifty percent of the time,

Vinod: How do you find out a person's overall hearing thresholds

Audiologist: The results obtained on pure tone audiometry will be plotted on a graph called an audiogram which shows intensity against frequency. In pure tone

Audiologist describing the audiogram

: audiometry, the hearing threshold or pure tone average is taken as the avera of a person's hearing threshold at 5OO Hz 1OOO H and 2OOO Hz.

Vinod points out the circles and crosses on the audiogram.

: Vinod: On this audiogram you have marked some circles and crosses. What do they stand for?

Audiologist pointing out all the symbols marked on the audio-gram and explaining then

: Audiologist: The circles show the hearing threshold of a person 's right ear and the crosses show the hearing threshold of his left ear. The other sign (]) which you see represents his hearing through hone conduction.

Vinod: Is bone conduction a diffe-rent test from pure tone audiometry

Audiologist: No, in pure tone audiometry we have to find out a person's hearing thresholds through air conduction first, that is when the signal is given through the earphone to the external ear, then we test for bone conduction

Focus on the earphone

Audiologist describing the bone conductionvibrating .and showing how it is to be worn. : using this bone conduction vibrator which is placed directly behind a person's ear on the bony part. The sound reaches the inner ear through this bone conduction vibrator.

Vinod *t* What is the use of finding out thresholds separately for air and bone conduction?

Audiologist: It helps us in identi-fying and distinguishing between different types of hearing losses.

Audiologist describing an audiogram showing a conductive hearing loss

In a person, for instance, whose bone conduction thresholds lie within normal limits but whose air conduction thresholds are poor, we can conclude that he has a conductive hearing loss.

Audiologist describing an audiogram showing a sensori-neural hearing loss

If both air conduction and bone conduction threshold's are affected, it is usually due to a sensorineural hearing loss.

Audiologist describing an audiogram showing a

In a mixed hearing loss, the air and bone conduction threshold's both will be affected

mixed hearing loss : and the difference between the air and bone conduction threshold's will not be much.

Vinod: Is there a certain criteria for deciding when a person's hearing is normal and when he is considered to have a hearing loss?

Audiologist describing the different degrees of hearing losses by pointing it out on the audiogram. : Audiologist: Generally, a person's hearing is considered normal, if his pure tone average threshold's lie between O-25 decibels. A person whose hearing thresholds lie between 25-4O dB is considered to have a mild hearing loss. If the person's hearing threshold lie between 41-55 dB, it is considered as a moderate hearing loss and if the threshold 's lie between 55-7O dB, a person is considered to have a moderately severe hearing loss. A person is considered

: to have a severe hearing loss if his threshold 's lie between 71-90 dB and when threshold's lie between 91 dB and above a person is considered to have a profound hearing loss.

Vinod: I have a colleague who is called "stone-deaf". Does this mean he won't be able to hear at all?

Audiologist: People who are called stone-deaf usually have a profound hearing loss. However, even such people can hear very loud sounds and actually there is almost nobody who cannot hear at all.

Vinod: When you test one ear is the sound not heard by the other ear?

Audiologist: If both ears are normal or both ears have the same

: degree of hearing loss this problem doesn't arise. However, When we have one ear which is normal or which has a mild hearing loss and the other ear which has a profound hearing loss, when we test the ear with the more severe hearing loss, we might get thresholds that are actually better than what the real hearing thresholds of that ear should be. This is because the sound crosses over from the poorer ear (that is the ear with a more severe hearing loss) to the better ear. Even though, the sound is given to the poorer ear the better ear responds and thus the poorer ear 's hearing threshold may appear to be better than it actually is. To overcome this problem in such cases we do a procedure called 'masking'.

: where we give noise to the ear Which is not being tested to avoid participation of that ear while testing the other ear.

Focus on Vinod pointing out to the Madsen OB 822 audiometer.

: Vinod: That audiometer over there is a much bigger one. Is it used for the same purpose as this one?

Audiologist: On this audiometer we can do tests to find out a person's hearing threshold for speech. *This* is called the speech reception threshold. It is the lowest intensity level at Which a person can repeat speech material (spondee words which are bisyllabic words with equal stress on both syllables. For examples AIR PLANE, BASE BALL) correctly fifty percent of the time.

We can also find out a person 's ability to listen to

: and discriminate between similar sounding words correctly. This is called the speech discrimination test. This establishes the percentage of correctly peeceived phonetically balanced monosyllabic words or consonant vowel combinations. This test is used as an indicator of social adequacy index for speech communication, in selection of hearing aids etc.

Vinod: How do you test a young child's hearing? Do you think a young child will be able to sit like this for such a long time?

Audiologist: For very young children we don't follow this same procedure of testing. By about three months of age, infant's start listening to sounds and are able to determine the location of the sound source by turning towards it or looking for it. Hearing

: assessment is therefore generally centered around behavioural observation. The infant is placed in a high chair or on the mother's lap between two loudspeakers located at a forty five degree angle from/both sides of the child like this. An auditory signal is then presented at a level well above threshold and behavioural responses are observed. The signal is then slowly decreased. Threshold is usually defined as the lowest presentation level at which an infant responds fifty percent of the time.

Focus on the arrangement for testing young children by behavioural observation.

Vinod: What sort of a signal do you use when testing young children.

Audiologist: The nature of the signal varies, it may be through various noise makers such as squeeze toys, bell, rattle, or spoon in a cup. These signals are considered

Focus on various noise makers like bell rattle, squeeze toys.

: favourable since they maintain a certain amount of interest in young children or infants.

Vinod: That's very interesting. I didn't know children could be tested even at such young ages. Actually how soon can you detect a hearing-impairment in young infants?

Audiologist: It is possible to detect a hearing problem even in a newborn with the sophisticated equipments we have now-a-days.

Vinod : At what age do you think children will be able to sit and respond while wearing these earphones?

Audiologist: Generally a child of four to five years old will be able to follow this procedure so we can find out their hearing ability by doing pure tone audio-metry.

: Vinod: Thank you, you have told me many things which I was not aware of and given me insight into what is an audiological evaluation and its importance.

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