

***AUDIOLOGICAL EVALUATION OF  
MENTALLY RETARDED  
CHILDREN***

**REG. NO: M 9504**

***AN INDEPENDENT PROJECT WORK SUBMITTED IN PART FULFILLMENT FOR  
THE FIRST YEAR MASTERS DEGREE IN SPEECH AND HEARING TO THE  
UNIVERSITY OF MYSORE.***

***ALL INDIA INSTITUTE OF SPEECH AND HEARING  
MYSORE 570 006  
INDIA  
MAY 1996***

***DEDICATED TO***

***Mummy, Daddy, Achu, Shobs & Sweets***

***' I AM SO GLAD YOU'RE MY "FAMILY", LOVE YOU ALL SO MUCH. '***

## CERTIFICATE

This is to certify that the independent Project entitled  
**"AUDIOLOGICAL EVALUATION OF MENTALLY RETARDED CHILDREN"**,  
is the bonafide work, done In part fulfillment for the First Year of the  
Master's Degree In Speech and Hearing of the student  
with Registration No: M 9504

Mysore  
May, 1996

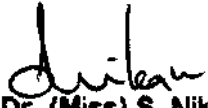


Director  
All,India Institute of  
Speech and Hearing  
Mysore - 570 006.

## CERTIFICATE

This is to certify that this Independent Project entitled  
**"AUDIOLOGICAL EVALUATION OF MENTALLY RETARDED CHILDREN",**  
has been prepared under my supervision and guidance.

Mysore  
May, 1996

  
**Dr. (Miss) S. Nikam,**  
GUIDE,  
AIISH, Mysore

## **DECLARATION**

**I hereby declare that this Independent Project entitled "*AUDIOLOGICAL EVALUATION OF MENTALLY RETARDED CHILDREN*", is the result of my own study undertaken under the guidance of Dr. (Miss) S. Nikam, Director, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier at any University for any other Diploma or Degree.**

***Mysore***  
*May 1996*

***REG.NO.M9504***

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# AUDIOLOGICAL EVALUATION OF MENTALLY-RETARDED CHILDREN

## INTRODUCTION:

Modern audiologic assessment is based on pure-tone audiometry, which is a reliable procedure for assessing auditory sensitivity in humans. Reliable auditory sensitivity information can lead to valid assumptions about auditory abilities. Pure-tone audiometry provides an index to the basic functional relationship between a person and his environment in terms of auditory input and stimulation. Pure-tone data provide an ordered set of threshold responses to stimuli which represent a frequency range of auditory sensitivity. Audiologists consider pure-tones to be neutral stimuli which can be accurately specified and controlled. [Lloyd 1972]

Considerable information for the diagnosis of hearing impairment can be obtained from pure-tone data. Such data include individual auditory sensitivity in the low, middle and high frequencies and the possible differential between sensitivity to air conducted and bone conducted sounds. Skillful interpretation of pure-tone thresholds can provide gross differential diagnosis of the site of auditory impairment and communication disability. As an initial step in differential diagnosis of site and auditory impairment, the relationship between thresholds for air conducted and bone conducted stimuli has been used to differentiate between the three gross auditory pathologies—conductive, sensorineural and mixed. Audiometric variables that affect testing are acoustic and environmental factors, calibration, instructions, threshold criteria, subjective factors, etc.

Audiologists have two major areas to control, stimulus and response. The stimulus is under the control of the audiologist. Client has response control. The skills of the examiner need to be mobilized to their fullest extent in both areas. Audiological assessments are complex psychophysiological evaluations, in working with persons whose motor skills are not intact or whose intelligence is below a certain level, the task is compounded. Such persons may be categorized as the "difficult-to-test". When considering the client variables, the above mentioned form the major



category of client factors affecting audiometric test results. The examiner variables such as professionalism, language, attitude, personality, emotional state, etc. also are important factors which could affect audiometric results.

**DEFINITION:**

Mental retardation is the condition which originates during the developmental period and is characterized by sub-average intelligence resulting to some degree in social inadequacy [ Sub-average intellectual functioning means impairment in maturation, learning and social adjustment]

A review of literature on testing the hearing of the mentally retarded reveals meagre research in the application of audiometric methods until the 1950's and 1960's. Literature reveals that retarded children tend to have substantial hearing disturbances [Birch & Mathews '51 and Kodman '58]. It is seen that mentally retarded children are very difficult to test, due to their inattentiveness and difficulty in expressing themselves.

Literature also reveals that there is high prevalence of sensorineural hearing impairments in retardates than is usually found among the non-retardates. This high probability could be understood when one considers the factors common to organically caused retardation and sensorineural hearing impairment.

**REVIEW OF LITERATURE:**

According to studies by Lloyd & Reid 1967, Lloyd & Moore 1972; audiometric variables [ Instructions. stimulus presentation, test environment, method of response, testing time]; subject selection [ sample size, subject motivation, responsivity, age and intelligence] and hearing loss criteria were cited as significant contributors to the inconsistency of results seen.

Problems encountered in testing some retarded persons have resulted in improved pure-tone methodologies.

- Eye puff was used by Atkinson 1960; as an instrumental avoidance procedure. Atkinson found that his retarded subjects responded better when they were instructed to close their eyes when they heard a sound than they did when conditioning was attempted without verbal instructions.

- Most new techniques use positive reinforcement through instrumental techniques. The reinforcement include;

- (a) Electrical toys (D'saro & Grey 1967; Futon & Graham 1966; Wolf & McPherson 1959)
- (b) Edibles (Bricker & Bricker 1969; Fulton & Spradin 1971)
- (c) Sides and fikh strips (Lloyd 1965 & Weaver 1965)
- (d) Assorted trinkets (Knox 1960; Meyerson & Michael 1960)
- (e) Lights (McPherson 1960; Wolf & McPherson 1959)

- The ear choice and modified ear choice methods (Atkinson 1960; Bradley et al 1955; McPherson 1960) and play audiometry (Barr 1955; Lloyd 1965 & Webb et al 1965) have been successful/ used with retardates.

When considering the reliability and validity of the tests done on the mentally retarded population!; several ideas were put forth;

- When procedural adjustments and presentation factors are considered, the retarded can be expected to provide reliable results (Lloyd 1965; Lloyd & Melrose 1966; Young 1968)

- Lloyd et al 1968; reported good reliability in using TROCA with retarded.

- Futon & Spradin 1971. presented data showing high intrasession reliability over six sessions using tangible reinforcers with severely retarded children using both ascending and descending methods.

These studies demonstrate reliability and suggest that retardates do not have inherent etiologic and biologic differences that causes unreliable pure-tone measures.

Intratest reliability does not ensure validity. In reality, validity in any population is conjectured from certain accepted principles and relationships. The validity of most procedures have been determined by their relation to pure-tone techniques. Pure-tone audiometry then becomes a reference for validity. There have been numerous studies using pure-tone techniques as one of the comparative measures (Aitkinson 1960; Barber & Rose 1969; Barr 1955; Fulton 1962; Lloyd 1965; Perry 1956; Meyerson 1958; Webb et al 1964; Young 1968). All these demonstrate the validity of pure-tone audiometry with the retarded.

Most of the research done on testing the mentally retarded population has considerable promise for application to other "difficult-to-test" population.

**PURPOSE :**

Pertaining to the topic; the main purpose for the audiological evaluation of the mentally retarded children (having a mental age of 5-10 years and moderate IQ of 33-70) is to form an idea on how to;

-test these mentally retarded children using pure-tone audiometry and thus test its reliability and validity.

-the various steps involved in forming a proper diagnostic tool for testing the hearing of the MR; as no such matter has been provided in any of the texts and this will also help if further reference is needed on testing of MR.

-the ease or the various problems that might be encountered while testing the MR subjects and how to overcome them.

## **METHODOLOGY FOR TESTING**

### **Subjects:**

Six (6) moderate grade mentally retarded children within the age range of 5-16 years, mean age of 10,5 and median age of 9.5 years; having a mental age range of 5-10 years and IQ level of 35-70, were selected randomly. Three (3) males and Three (3) females were selected as the subjects. They had no other associated problems as; -motor problems, visual defects, temper tantrums, etc. The subjects have been grade as MR through psychological evaluations - SFB, 3 FFB and developmental schedules by experienced clinical psychologists. The subjects have been chosen from various backgrounds and language is not considered as a bar here.

### **Procedure :**

#### **(a) Equipment -**

- \* Diagnostic Clinical audiometer (OB322). calibrated under routine AC'BC procedure, according to ANSI -1975
- \* TDH - 39 earphones
- \* Bone vibrator (B-70)
- \* Audiogram sheets

#### **(b) Materials -**

- \* Blocks and Plastic box
- \* Toys
- \* Picture Cards

#### **(c) Method -**

The testing of six subjects was done in a sound treated air-conditioned room permissible noise level is 30db[A] according to ANSI-'75] which is a two room situation. The experimenter sat in the control room and the subject sat in the *test* room [either alone or accompanied by an adult]

The testing of hearing was done using the Diagnostic clinical audiometer

OB822. Earphones (TDH-39) was placed on the subject to test the AC mode. Bone vibrator (B-70) was used to test the better ear. The frequencies that were tested were 500 Hz, 1 KHz, 2 KHz, 4 KHz and 8 KHz (AC) and 500 Hz to 4 KHz (BC).

Tracking of thresholds was done by starting to present the tone at 40 dBHL and decreasing in 5 dB steps til the subject stopped responding . These values were plotted as thresholds of hearing on the audiogram sheets.

As response strategy, 3 alternatives were given depending on the child's interest. The child was conditioned before testing to;

- putting blocks into a box
- point to picture of ear
- point to the ear; everytime he/she heard a sound.

\*Whenever the child responded rightly he she was shown a toy as form of positive reinforcement.

After testing two frequencies: a rest period of 30 secs to 1 min was given (if needed). A one second gap was given while testing each frequency. Re-testing was also done when the response given by the subject was inconsistent.

As said earier; the response of the subjects was plotted on an audiogram sheet. Behind each audiogram, the following was noted;

- the accuracy of the results.
- problems faced while testing.
- special activities encorporated to facilitate testing.
- how the subject responded.
- if retesting was done, how many times if so
- what was the response strategy used

It was to be seen that with this methodology what is the validity and reliabiity of testing the moderate grade of mentally retarded children.

CASE I.

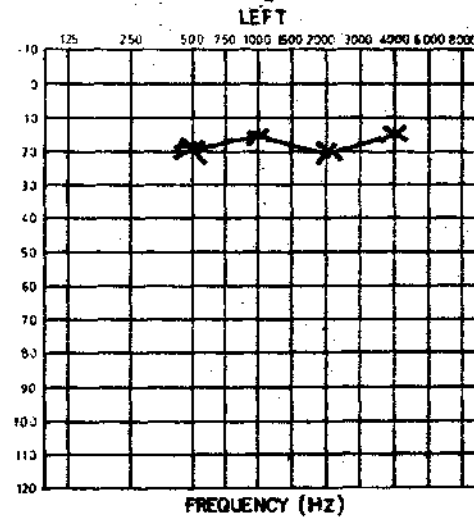
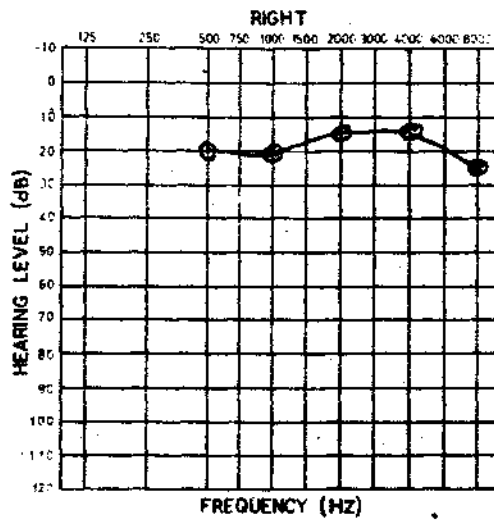
ALL INDIA INSTITUTE OF SPEECH AND HEARING, MYSORE - 570 006

DEPARTMENT OF AUDIOLOGY  
 CASE NO : 1 Audiological Evaluation

Name: Naya      Test: Pre      No: 1  
 Age: 19 yrs      Sex: F/M      Case No: 107916  
 Audiometer Used: PURE-TONE      AUDIOGRAM      Post      Date: 13.03.92  
 Treatment

KEY TO SYMBOLS

	RIGHT	LEFT
AIR CONDUCTION		
UNMASKED	O	N
MASKED	Δ	▽
NO RESPONSE	○	X
BONE CONDUCTION		
UNMASKED		
MASKED		
NO RESPONSE		
FIT		F
SOUND FIELD		S
NO RESPONSE		S



**CASE 1.**

NAME:A1  
CHRONOLOGICAL AGE : 10 YRS  
MENTAL AGE : 8 YRS  
IQ ;75  
SEX: FEMALE  
LANGUAGE : ENGLISH

**TEST RESULTS :**

Conditioning was done first using the blocks The case was then instructed verbally to respond to stimulus It was subtly supplemented with gestures also.

As response strategy she used block placement. She responded very consistently and fast for her right ear. When testing for the left ear was done, she started to get restless and responses were not consistent.

A rest period was recommended but due to personal difficulties of the client's parents testing was to be resumed only later.

Testing of the right ear took about 5-8 mins but while testing the left ear. she stopped responding consistently.

**CASE 2.**

ALL INDIA INSTITUTE OF SPEECH AND HEARING, MYSORE - 570 006

DEPARTMENT OF AUDIOLOGY  
CASE NO: 2

Name:

Age: 16 yrs

Sex: F/M

**D.Lalitha**

Test

No.:/

Case No.:

Date: 23-03-96

Audiometer Used OB-822 Clinical

Audiometer

PURE-TONE

AUDIOGRAM

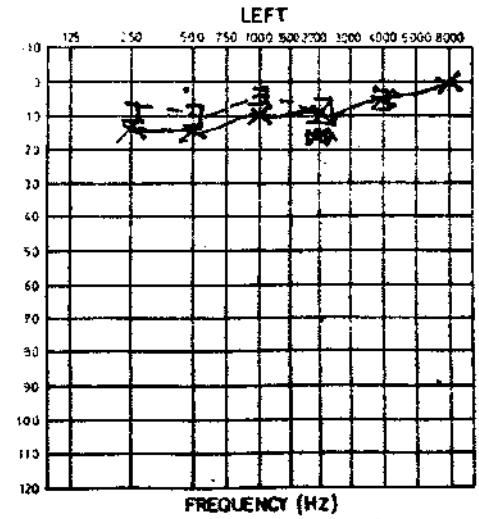
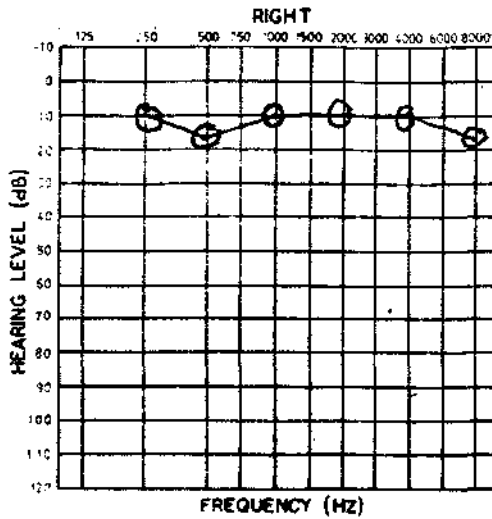
Pre

Post

Treatment

**KEY TO SYMBOLS**

	RIGHT	LEFT
AIR CONDUCTION		
UNMASKED	O	X
MASKED	Δ	▽
NO RESPONSE	⊙	⊗
BONE CONDUCTION		
UNMASKED	[	
MASKED		
NO RESPONSE	{	}
FIT		F
SOUND FIELD		S
NO RESPONSE		N





**CASE 2:**

NAME; A2  
CHRONOLOGICAL AGE : 16 YRS  
MENTAL AGE : 10 YRS  
IQ : 75  
SEX: FEMALE  
LANGUAGE : KANNADA

**TEST RESULTS :**

The case understood the instructions with both verbal and gestural cues (conditioning was done first). She was very slow in her responses to the tones presented.

On response strategy, placing blocks was done. Once the set of blocks was over, she had to be instructed again as to continue with the same blocks. She would then, place the blocks back into the box and start again.

Her right ear threshold was got fast. She had to be given a rest period before testing the left ear (30 secs) as her responses started to become inconsistent.

BC testing was done for the better ear; for which she had to be instructed (verbally and gesturally) again as to what to do.

Here, positive reinforcement did not show any significant results. Testing time was 30 - 35 minutes.

**CASE 3.**

ALL INDIA INSTITUTE OF SPEECH AND HEARING, MYSORE - 570 006

DEPARTMENT OF AUDIOLOGY

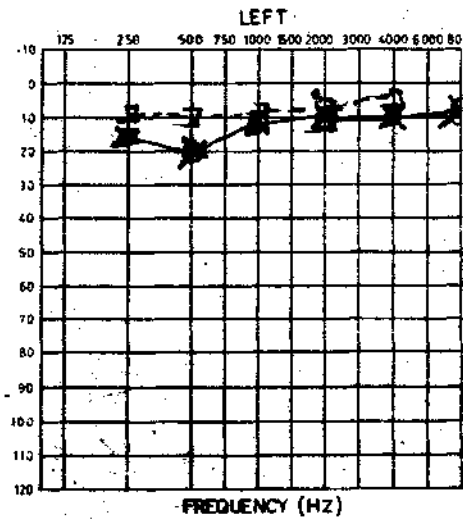
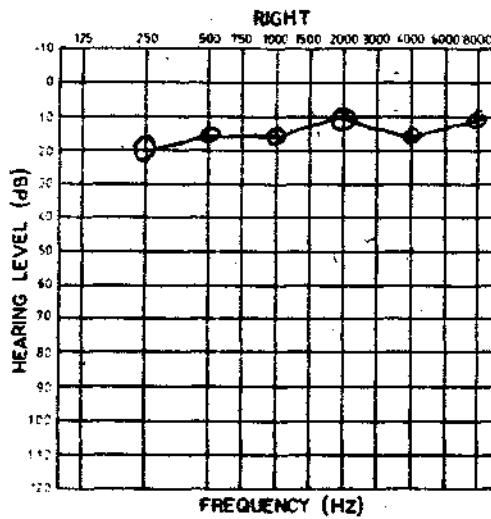
CASE.NO:3

Audiological.Evaluatio

Name: Padmasree Case No:92386  
 Age: 6yrs Sex: F/M Test No: 2 Date: 23-03-96  
 Audiometer Used O B - Clinical-Audiometer PURFTONE AUDIOGRAM PrePost Treatment

**KEY TO SYMBOLS**

	RIGHT	LEFT
AIR CONDUCTION		
UNMASKED	○	○
MASKED	△	▽
NO RESPONSE	○	×
BONE CONDUCTION		
UNMASKED	[	)
MASKED	[	)
NO RESPONSE	[	)
FIT		F
SOUND FIELD		S
NO RESPONSE		S



**CASE 3:**

**NAME :A3**  
**CHRONOLOGICAL AGE : 7 VRS**  
**MENTAL AGE ; 5 YRS**  
**IQ :55**  
**SEX: FEMALE**  
**LANGUAGE : KANNADA**

**TEST RESULTS :**

The case was very restless and she Wanted her mother white testing: so mother was allowed to the test room to help in placing blocks (which she found easier to do).

She understood the instructions better when she was told what to do by her mother (she was conditioned first).

After testing from 1-4 KHz for the right ear, she was given a rest period (as she was getting restless) of one minute before testing the other frequencies. She was then given a rest period of 30 seconds before testing the left ear. Left ear testing went on faster. BC testing was then done. It took 15 minutes as she started to cry and tel she wanted to go. But when she was shown the toy:she calmed down and testing was continued.

Testing took a total of 45 minutes. Mother had to keep on repeating the instructions (2-3 times) whenever the case started to show false responses.

**CASE 4.**

ALL INDIA INSTITUTE OF SPEECH AND HEARING, MYSORE - 570 006

DEPARTMENT OF AUDIOLOGY

CASE NO:4 Audiological Evaluation

Name:

Guatham

Case No.:

Age:7yrs

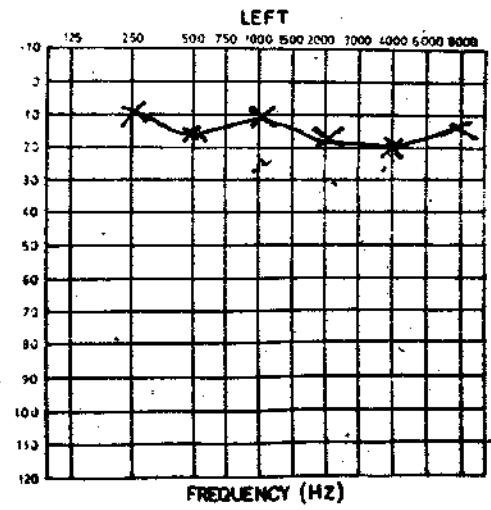
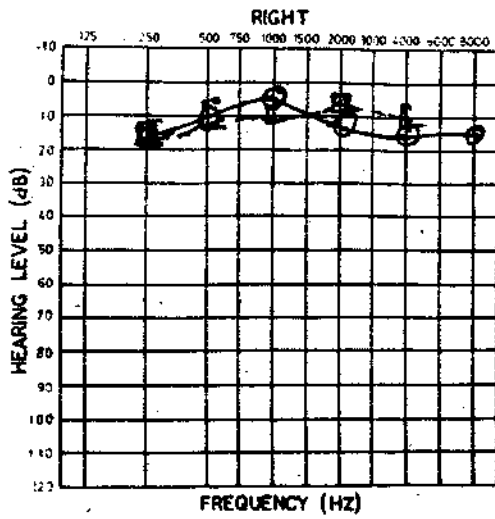
Sex: F/M

Test No:1 Date:23-0396

Audiometer used O-822 Clinical Audiometer PURE-TONE AUDIOGRAM Pre Post Treatment

**KEY TO SYMBOLS**

	RIGHT	LEFT
AIR CONDUCTION		
UNMASKED	O	V
MASKED	Δ	▽
NO RESPONSE	⊙	⊗
BONE CONDUCTION		
UNMASKED	L	I
MASKED		
NO RESPONSE		
FIT	F	F
SOUND FIELD	S	S
NO RESPONSE	S	S



### **CASE 4:**

**NAME:A4**  
**CHRONOLOGICAL AGE ; 7 YEARS**  
**MENTAL AGE : 5 YEARS**  
**IQ : 55**  
**SEX;MALE**  
**LANGUAGE : KANNADA**

### **TEST RESULTS :**

Conditioning was done first. The case was instructed both verbally and gesturally. Response strategy used was placing the blocks for which he responded with average speed. The testing had to be stopped twice while testing the right ear; since he would stop responding suddenly and he had to be instructed again. He responded positively for the toy shown in the beginning but later lost interest in it.

A rest period of 30 seconds was given before testing left ear. Here also for 4KHz he had to be told twice as to place the blocks.

Before Bone Conduction testing, for which he was given rest period of 30 seconds. he was again instructed before testing was continued.

Testing took up to 40 minutes time. Mother was present in the test room while testing was done.

**CASES:**

NAME;A5

CHRONOLOGICAL AGE : 9 YEARS

MENTAL AGE: 6 YEARS

IQ : 65

SEX: MALE

LANGUAGE:KANNADA

**TEST RESULTS:**

Case was uncooperative and did not respond to the conditioning, stimuli and positive reinforcement.

Hearing is reported to be normal (Reported by mother).

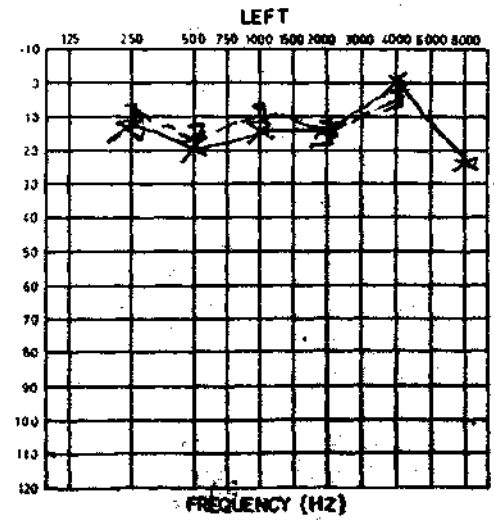
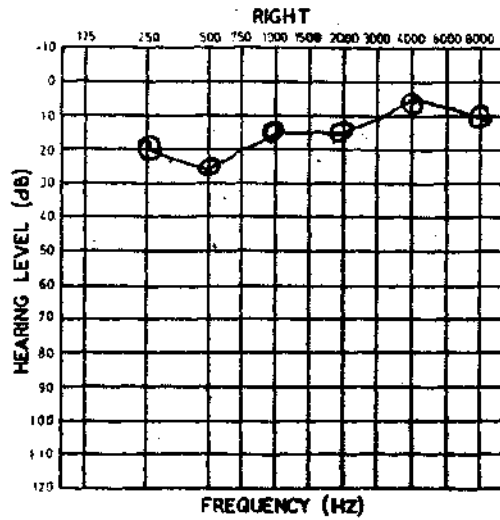
**CASE 9.**

ALL INDIA INSTITUTE OF SPEECH AND HEARING. MYSORE - 570 006  
 DEPARTMENT OF AUDIOLOGY

Name: S.N. Praveen CaseNo: 38818  
 Age: 14 yrs Sex: F/M Test NO: | Date: 8-04-96  
 Audiometer Used: OB-822 clinical Audiometer PURE-TONE AUDIOLGRAM Pre Post Treatment

**KEY TO SYMBOLS**

	RIGHT	LEFT
AIR CONDUCTION		
UNMASKED	○	×
MASKED	△	▽
NO RESPONSE	○	×
BONE CONDUCTION		
UNMASKED	{	
MASKED	{	
NO RESPONSE	{	
FIT		F
SOUND FIELD		S
NO RESPONSE		S



**CASE 6:**

NAME:A6  
CHRONOLOGICAL AGE : 14 YEARS  
MENTAL AGE : 10 YEARS  
IQ : 68  
SEX : MALE  
LANGUAGE : ENGLISH

**TEST RESULTS :**

The case was instructed verbally, which was supplemented by gestures. Instructions had to be repeated twice before he started responding to the stimulus.

As response strategy, he used placing the blocks whenever he heard the tone. He responded consistently for the right ear, but his responses were slow. Before testing left ear he had to be given a rest period of ten seconds only. Instructions did not have to be repeated again.

For both the ears his responses were quite consistent. A rest period of ten seconds was given again before Bone Conduction testing.

The total test period taken was 25 minutes. Here positive reinforcement was not necessary.



# RESULTS :

**\*The cases were instructed both verbally and with gestures.**

DASE NO:	1	2	6	3	4	5
CHRONOLOGICAL AGE	10 YEARS	26 YEARS	14 YEARS	7 YEARS	7 YEARS	9 YEARS
MENTAL AGE	8 YEARS	10 YEARS	10 YEARS	5 YEARS	5 YEARS	6 YEARS
METHOD OF RESPONSE	PLACING BLOCKS	PLACING BLOCKS	PLACING BLOCKS	PLACING BLOCKS	PLACING BLOCKS	-NL-
PRESENCE OF CEMENT	ABSENT	ABSENT	ABSENT	PRESENT	PRESENT	-NL-
PRESENCE OF ADULT	ABSENT	ABSENT	ABSENT	PRESENT	PRESENT	PRESENT
REST PERIOD	PRESENT	PRESENT (30 SECS)	10 SECS-LT 10 SECS-BC	1 WIN -KI 30 SECS-LT	30 SECS-LT 30 SECS-BC	-NL-
COOPERATIVE RESTLESS SLOW-RESPONSE						
CONSISTENCY SLOW-RESPONSE	CONST. RT	CONSISTENT IN BOTH EARS	CONSISTENT IN BOTH EARS	CONSISTENT AFTER 2 TESTS	CONSISTENT AFTER RE-TESTS	DO NOT RESPOND
HEARING	REPORTED TO BE NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	REPORTED TO BE NORMAL
TIME PERIOD	DD-NCD COMPLETE TEST 1 DAY		25 MINUTES	45 MINUTES	40 MINUTES	-ML-

**\*MEAH AGE: 18.5 YEARS - MEAH AGE : 8.5 YEARS**

## **DISCUSSION**

From the review of literature, it has been seen that various techniques were tried for pure-tone testing of the retarded. Among the most successful were;

- TROCA (Lloyd et al 1968)
- Eye Puff (Atkinson 1960)
- Positive Reinforcement (Electrical Toys, Lights, Slides & Film Strips)
- Ear Choice Method (Atkinson 1960)
- Play Audiometry (Barr 1955; Lloyd 1965)

For testing the six cases, the previously mentioned three response techniques (putting blocks into box, pointing to the picture of ear and pointing to the ear) were introduced to the cases and it was observed that the most consistent response was for placing the blocks in the box; in all the cases. The testings showed the following:

### **#1 : For cases of mental age above 8 years:**

- Tested quite efficiently without use of positive reinforcement to get the thresholds.
- Their responses were slow but consistent.

### **#2 : For cases of mental age below 8 years:**

- Responded better with use of positive reinforcement
- An adult had to accompany the child in the test room
- Repeated testing was required to get the threshold values (consistent ones).
- Longer time was required for testing

### **#3 : General Observation.**

- A rest period of 30 seconds is to be given before testing each ear (for both AC & BC modes).
- Placing the blocks was seen as the best response mode.

All the above mentioned points give us a more systematized way of carrying out pure-tone testing for the moderate range of retarded (mental age group as mentioned in the study). Also placing the blocks in the box can be mentioned as a very good response technique for the retarded. (All the above cases are reported to have normal hearing).

### **SUMMARY A CONCLUSION**

The results of this study which was conducted on six moderate mentally retarded children (7-16 years); out of which 3 were males and 3 females with a mean age of 10.5 years and median age of 9.5 years, showed that;

- a) Children with a mental age of 8 and above performed well in placing blocks in the box. Though slow, they did give consistent responses. They did not need positive reinforcement.
- b) Children with mental age between 5 and 8, tended to be less cooperative. They needed the presence of an adult in the test room. They performed better with positive reinforcement. Repeated testing was required to get consistent responses.
- c) A rest period of 30 seconds is essential before testing each ear for children with a mental age of 5 to 10 years (for both air conduction and bone conduction).

Thus as the present study shows; there is greater ease of testing the moderate mentally retarded for pure-tone audiometry as mental age increased.

### **IMPLICATIONS FOR FURTHER RESEARCH :**

1. To carry out similar study using moderate to severe mentally retarded children.
2. To see if other type of reinforcement or techniques will give better results more easily.
3. Carrying out this study on a larger population.

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