

REVIEW OF STUDIES ON CENTRAL AUDITORY DISORDER (C.A.D) IN HUMAN
IN LAST 15 YEARS

Register NO.M8916

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

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To my parents

..... without whom, I am nothing
and

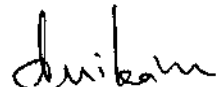
My brother,

.. . for being my best friend.

CERTIFICATE

This is to certify that the Independent Project entitled: Review of Studies on Central Auditory Disorders (C.A.D.) in Human in Last 15 years is the bonafide work, done in part fulfilment for First Year M.sc, (Speech and Hearing) of the student with Register No.M8916.

Mysore
May 1990


Director
All India Institute of
Speech and Hearing
Mysore-6

CERTIFICATE

This is to certify that the Independent Project entitled: Review of studies on Central Auditory Disorders (C.A.D) in Human in last 15 years has been prepared under my supervision and guidance.

Mysore
May 1990


GUIDE

DECLARATION

This Independent Project entitled" Review of Studies on Central Auditory Disorders (C.A+D) in Raman in last 15 years" is the result of my own study undertaken under the guidance of Dr.(Miss) S.Nikam, Professor and Head of the Department of Radiology, 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, 1990

Register NO.M8916.

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TABLE OF CONTENTS

| CHAPTER | | Page :No. |
|---------|--------------------|-----------|
| 1. | INTRODUCTION | - 1-3 |
| 2. | METHODOLOGY | - 4-6 |
| 3. | SUMMARY OF STUDIES | - 7-10 |
| 4. | RESULTS | - 11 |
| 5. | BIBLIOGRAPHY | - 12-14 |

INTRODUCTION

Central Auditory Disorders (CAD) also known as hidden hearing loss is an unusual auditory disorder, in the sense that the peripheral auditory system shows normal hearing acuity but the patient complains of poor speech discrimination and perception, especially in noisy areas.

It is very important for an audiologist to know about the central auditory functions, because in some cases, the audiologist is the first health professional to see a patient who complains of unusual auditory symptoms possibly indicating central lesion. Hence the audiologist has to test and refer for appropriate medical attention.

Various degenerative diseases, biochemical alterations of the brain, and a host of minimal neurological deficits, either acquired or congenital, may affect higher auditory process (Dublin, 1976). When such conditions occur, appropriate central auditory evaluations provide insights that are not obtainable by any other diagnostic avenue.

In addition to these, there is new information available which indicates that the central auditory nervous system may be affected, secondary to other disorders such as middle ear effusions. Also, the noise induced hearing loss and presbycusis

have been linked to the degeneration of central auditory
Reasons in the brainstem of animals (Theopold, 1975).

There are also indirect or secondary effects on central auditory nervous system from the other peripheral disorders that often affect hearing, for eg. large acoustic tumour that has compressed the brainstem. These type of lesions may cause hydrocephalus or vascular constriction which may affect the brainstem or cerebrum. Other examples are oedema and trauma of the head or the auditory mechanism that may have compressed or displaced brain tissue for from point of damage. This in turn may affect higher auditory functioning in a variety of ways. Hence the central auditory testing cannot be ignored.

Various tests have been used in central auditory testing such as filtered speech/tests, diehotic listening tests, compressed speech tests etc. but until now, no single test has been proved to be provide conclusive diagnostic information. Hence more/research is needed on central auditory testing for better evaluation purposes.

Aim of the study: The aim of this study is to review the various articles on CAD in the last fifteen years and see the trend in the following aspects.

1. Patients tested i.e. whether more number of children or adults are tested.

2. Test, which is most frequently need.
3. Type of articles: Whether the articles are/review experimental or case studies.
4. Author, Who has contributed moat to the field of central auditory disorders.
5. The journal in which most number of articles on CAD are published.

METHODOLOGY

The journal articles dealing with Central auditory disorders in human beings were selected for the study. The articles were collected from various journals available in the All India Institute of Speech and Hearing library over a period of fifteen years (1975-1989). The journals included were:

1. Journal of Speech and Hearing Disorders.
2. Journal of Speech and Hearing Research.
3. Scandinavian Radiology
4. Ear and Hearing (Journal of American Auditory Society)

6. Radiology and hearing Education.
7. Brain and Language
8. Annals of Otorhinolaryngology
9. Archives of Otorhinolaryngology
10. Acta otolaryngologica
11. Laryngoscope
12. Hearing Instruments
13. Journal of Acoustical Society of America
14. British Journal of Radiology

A total of twenty six articles were available from these journals. The information from these articles were classified under following variables and were tabulated accordingly

in (Table1):

1. Type of articles - whether experimental, review or case study.
2. Tests used in the article
3. Type of presentation: whether monaural, dichotic or monotic
4. Linguistic states: syllables, words or sentence
5. Subject variables.
 - a) age or age range
 - b) sex Male(M) or Female(F)
 - c) handedness Right(R) or Left(L)
 - d) brain damage - present or absent
 - e) peripheral hearing - normal or not
 - f) learning disability.
6. Administration and other stimulus variables:
 - a) memory or recognition: whether the response has to be given based on memory(M) or recognition (R) of signal.
 - b) Frequency range tested
 - c) Response modality: Verbal (V) or Gestural (G) or Automatic (A) .
 - d) Speech stimulus variables
 - i) compressed speech
 - ii) competing speech
 - iii) synthetic speech
 - iv) filtered speech

7. Other variable, pertaining to the patients or to the instrument.

In order to determine the trend regarding the test most frequently used in the detection of central auditory disorder, and also to find out the trend regarding the kind of population (whether children or adults) most frequently tested, a table was designed which indicates the number of patients tested using each test and also the number of studies in which the test was used (Table 2).

After compiling the data in tabular forms, it was analyzed to determine the trend in various aspects.

SUMMARY OF STUDIES

(TABLE – 1)

| YEAR | AUTHORS | TYPE OF ARTICLE | TESTS USED | TYPE OF PRESENTATION LINGUISTIC STATUS | | | | | | AGE RANGE | SEX | SUBJECT VARIABLES | | | | ADMINISTRATION AND OTHER STIMULUS VARIABLES | | | | | | | |
|------|-----------------------------|-----------------|---------------------------------------|--|----------|---------|-----------|-------|-----------|------------------------------|-----|-------------------|--------------|---|--------------------|---|-----------------|-------------------|-------------------|------------------|------------------|-----------------|---|
| | | | | MONO AURAL | DICHOTIC | MONOTIC | SYLLABLES | WORDS | SENTENCES | | | HANDEDNESS | BRAIN DAMAGE | PERIPHERAL HEARING | LEARNING DIABILITY | MEMORY OR RECOGNITION | FREQUENCY RANGE | RESPONSE MODALITY | SPEECH STIMULI | | SYNTHETIC SPEECH | FILTERED SPEECH | OTHER VARIABLES |
| | | | | | | | | | | | | | | | | | | | COMPRESSED SPEECH | COMPETING SPEECH | | | |
| 1975 | Jerger & Jerger | Experimental | ART, PIPB SSI, SSW | + | + | + | + | + | + | 24-65 | M/F | R/L | + | Normal, SN Hearing loss | - | R/Mem | 250-8KHz | V/G | - | + | + | - | - |
| 1975 | Grey, Miller & Rubin | Experimental | Puretone speech audiometry | + | - | - | + | - | - | - | - | - | + | Normal up 2KHz above 2KHz mild hearing loss | - | R/Mem | 250-8KHz | V/G | - | - | - | - | - |
| 1976 | Williford | Experimental | D.D. Filtered Speech B.F. R.A.S.P. | + | + | - | + | + | + | Children (age not mentioned) | M/F | R/L | + | Normal | + | Mem | - | V/G | + | - | - | + | - |
| 1977 | Manning; Jhonston & Beasley | Experimental | Cd. S.T. | + | - | - | + | - | - | 7.5 to 8.5 | M/F | - | - | Normal | - | Mem | - | V | + | - | - | - | Cases have auditory perceptual problems |
| 1977 | Oelfehlaeger | Case study | Puretone A.R.T. Cd. S.T. | + | - | - | + | - | - | 11yrs | F | - | + | + | - | Mem | - | V | + | - | - | - | Case has aphasia |
| 1978 | Mitten bergger | Experimental | B.F., C.S.T. R.A.S.P. Filtered speech | + | + | - | + | + | + | 13-65 | M/F | - | - | Mild-server SN loss | - | R/Mem | - | V/G | - | + | - | + | - |
| 1978 | Toscher | Experimental | Puretone, S.S.I. | + | + | + | - | - | + | 11-29 | M/F | - | - | Normal | - | R/Mem | - | V/G | - | + | - | + | - |
| 1979 | Mitten bergger | Experimental | B.F., D.D. R.A.S.P. Filtered speech | - | + | + | + | + | + | 26-46 | M | - | - | Normal | - | R/Mem | - | V/G | - | - | + | - | Cases are stutters |
| 1980 | Peronnahat. M. | Case study | A.B.R. | - | - | - | - | - | - | 40 yrs | M | R | + | - | - | - | - | A | - | - | - | - | - |

| YEAR | AUTHORS | TYPE OF ARTICLE | TESTS USED | TYPE OF PRESENTATION LINGUISTIC STATUS | | | | | | AGE RANGE | SEX | SUBJECT VARIABLES | | | | ADMINISTRATION AND OTHER STIMULUS VARIABLES | | | | | | | |
|------|------------------|-----------------|--|--|----------|---------|-----------|-------|-----------|------------------------------|-----|-------------------|--------------|----------------------|---------------------|---|-----------------|-------------------|-------------------|------------------|------------------|-----------------|---|
| | | | | MONO AURAL | DICHOTIC | MONOTIC | SYLLABLES | WORDS | SENTENCES | | | HANDEDNESS | BRAIN DAMAGE | PERIPHERAL HEARING | LEARNING DISABILITY | MEMORY OR RECOGNITION | FREQUENCY RANGE | RESPONSE MODALITY | SPEECH STIMULI | | SYNTHETIC SPEECH | FILTERED SPEECH | OTHER VARIABLES |
| | | | | | | | | | | | | | | | | | | | COMPRESSED SPEECH | COMPETING SPEECH | | | |
| 1980 | Musiek Geurkink | Experimental | S.S.W., B.F. R.A.S.P. filtered speech | + | + | - | + | + | + | Children (age not mentioned) | M/F | - | - | Normal | + | Mem | - | V | - | + | - | + | - |
| 1981 | Musiek, Morgan | Case study | D.D., C.S.T.S.S.M. | - | + | - | + | + | + | 55yrs | F | - | - | Normal | - | Mem | - | V | - | + | - | - | Case has vasculities |
| 1981 | Lendhart | Case study | A.R.T., speech audiometry S.S.W., A.B.R. | + | + | - | + | + | - | 13yrs | M | R | + | - | Mem | - | V/A | - | + | - | - | - | - |
| 1982 | Musiek, Geurkink | Experimental | S.S.W., B.F.R.A.S.P. filtered speech, D.D., C.S.T., A.B.R. | + | + | - | + | + | + | 43.2 (Mean age) | M/F | - | + | Normal mild SN loss | - | Mem | - | V/A | - | + | - | + | Cases have brain stem lesion |
| 1982 | Musiek Geurkink | Experimental | S.S.W., B.F.R.A.S.P. filtered speech, D.D. | + | + | - | + | + | + | 8-10 | M/F | - | + | Normal | - | Mem | - | V | - | + | - | + | Cases have auditory perceptual problems |
| 1982 | M.C. Spaden | Review | of C.A.D. in Geriatric population | | | | | | | | | | | | | | | | | | | | |
| 1983 | Musiek | Experimental | D.D., | - | + | - | + | - | - | 19-47 | M/F | - | + | Normal, mild SN loss | - | Mem | - | V | - | + | - | - | Cases have intracranial lesion |
| 1983 | Musiek | Experimental | C.S.T., | - | + | - | - | - | + | 16-62 | - | - | + | Normal mild SN loss | - | Mem | - | V | - | + | - | - | Cases have intraaxial lesion |
| 1985 | Welsh & Welsh | Experimental | Cd.S.T., R.A.S.P., B.F. Filtered speech | - | + | + | - | + | + | 60-89 | - | - | - | - | Mem | - | V | + | + | - | + | - | |

| YEAR | AUTHORS | TYPE OF ARTICLE | TESTS USED | TYPE OF PRESENTATION LINGUISTIC STATUS | | | | | | AGE RANGE | SEX | SUBJECT VARIABLES | | | | ADMINISTRATION AND OTHER STIMULUS VARIABLES | | | | | | | | |
|------|--------------------------|-----------------|---|--|----------|---------|-----------|-------|------------|------------|-----|-------------------|--------------|--------------------|--------------------|---|-----------------|-------------------|-------------------|------------------|------------------|-----------------|-----------------------------------|---------------------------------------|
| | | | | MONO AURAL | DICHOTIC | MONOTIC | SYLLABLES | WORDS | SENTEN CES | | | HANDEDNESS | BRAIN DAMAGE | PERIPHERAL HEARING | LEARNING DIABILITY | MEMORY OR RECOGNITION | FREQUENCY RANGE | RESPONSE MODALITY | SPEECH STIMULI | | SYNTHETIC SPEECH | FILTERED SPEECH | OTHER VARIABLES | |
| | | | | | | | | | | | | | | | | | | | COMPRESSED SPEECH | COMPETING SPEECH | | | | |
| 1985 | Stoch, Jerger & Flemming | Case study | S.S.L., P.I.P.B., Puretone speech audiometry | + | + | + | + | + | + | 79yrs | M | - | - | Mild SN loss | - | Mem | 250-8KHz | V/G | - | - | + | - | Case is a hearing aid user | |
| 1985 | Wimdhm | Experimental | S.S.W., B.F., Cd. S.T., A.R.T., Puretone audiometry , filtered speech | + | + | + | + | + | - | 7-11 | M/F | - | - | Normal | - | R/Mem/A | 250-8KHz | V/G | + | + | - | + | Cases are of black race | |
| 1986 | Baran, Musiek & Reeves | Experimental | D.D., S.S.W., Filtered speech | + | + | - | + | + | - | 20-41 | M/F | R | + | - | Mem | - | V | - | + | - | + | - | Cases had partial commissurectomy | |
| 1986 | Ferre & Wilber | Experimental | Filtered speech B.F., Cd. S.T. | + | + | - | + | + | + | 8-12 | - | - | - | - | Mem | - | V | + | - | - | + | - | - | |
| 1987 | Bergman & Hirsch | Experimental | CAT Scan C.S.T., | - | + | - | - | - | + | 53-82 | M/F | - | + | - | Mem/A | - | V/A | - | + | - | - | - | - | - |
| 1987 | Kricos | Experimental | Puretone Speech audiometry A.R.T., A.R.D., E.I.P.B., S.I.I. | + | + | + | + | + | + | 62-87 | - | - | - | SN hearing loss | - | R/Mem/A | 250-80KHz | V/G/A | - | - | + | - | - | Cases have hearing aid users |
| 1987 | Musiek & Baran | Review | of C.A.D. tests used since last 30 years. | | | | | | | | | | | | | | | | | | | | | |
| 1987 | Jerger & Jerger | Case study | A.B.R., M.L.R., L.R. A.R.T., | - | - | - | - | - | - | 11.5 years | M | - | - | - | + | A | - | A | - | - | - | - | - | Case has auditory perceptual problems |

Table No.2

| Tests | Number of cases | | | | Number of articles | | | |
|-----------|-----------------|--------|--------------|--------|--------------------|--------|--------------|--------|
| | Normal's | | Pathological | | Normal's | | Pathological | |
| | Children | Adults | Children | Adults | Children | Adults | Children | Adults |
| Pure tone | - | 14 | 50 | 39 | - | 1 | 2 | 3 |
| Speech | - | - | 1 | 25 | - | - | 1 | 2 |
| A.R.T | 3 | 10 | 51 | 87 | 1 | 1 | 2 | 3 |
| A.R.D | - | - | - | 24 | - | - | - | 1 |
| P.I.P.B | - | 10 | - | 85 | - | 1 | - | 3 |
| M.L.R | 3 | - | 3 | - | 1 | - | 1 | - |
| A.B.R. | 3 | 30 | 1 | 14 | 1 | 1 | 1 | 3 |
| L.R | 3 | - | 3 | - | 1 | - | 1 | - |
| S.S.W | - | 40 | 72 | 85 | - | 2 | 3 | 6 |
| S.S.I | - | 24 | - | 99 | - | 2 | - | 4 |
| R.A.S.P | - | 52 | - | 163 | - | 2 | - | 5 |
| B.F | 13 | 30 | 97 | 163 | 1 | 1 | 3 | 5 |
| C.S.T | - | 60 | 8 | 119 | - | 2 | 1 | 4 |
| Cd.S.T | 13 | - | 96 | 72 | 1 | - | 4 | 1 |
| D.D | 13 | 75 | 48 | 67 | 1 | 2 | 2 | 5 |
| Filtered | 13 | 30 | 97 | 171 | 1 | 1 | 3 | 6 |

Indicates: A.R.T: Acoustic reflex threshold, A.R.D: Acoustic reflex decay, P.I.P.B: Performance Intensity of phonetically balanced, M.L.R: Middle latency response, A.B.R: Auditory brainstem response, L.R: Late response, S.S.W: Staggered spondee word, S.S.I: Synthetic fusion, C.S.T: Competing sentence tests, Cd.S.T: Compressed speech tests, D.D: Dichotic digits, + presence of variable, - Absence of variable

Results

Frew the review done en the studies published in the last fifteen years on central auditory disorders. The following tread is evident.

1. More number of pathological adults were tested when compared to children with abnormalities.
2. Filtered speech tests are the most frequently used tests followed by binaural fusion tests.
3. Articles on central auditory disorders are published in the Ear and Hearing Journal (nearly 35%).
4. Experimental studies are more in number compared to reviews and case studies.
5. Musiek, F.E. is the pioneer in the field of central auditory disorders with about 25% of articles published in this area to his credit.

Other observations:

1. The interest on central auditory disorders is gradually reducing which is evident by the fact that no article has been published in 1988-89 in the Journals included for this study.
2. About 2% of the articles did not mention the age or age range of the subjects included in their study.
3. About 10% of studies were conducted on children with auditory perceptual problems.
4. About 60% of studies did not mention the handedness of the patients.

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