HANDOUT FOR AUDITORY MANAGEMENT OF AUDITORY PROCESSING DISORDER

Reg. No. M0105

An independent project submitted in part fulfillment for the
first year M.Sc. (Speech and Hearing)
University of Mysore,
Mysore

ALL INDIA INSTITUTE OF SPEECH AND HEARING
MYSORE - 570 006

May, 2002

CERTIFICATE

This is to certify that this independent project entitled "HANDOUT FOR AUDITORY MANAGEMENT OF AUDITORY PROCESSING DISORDER" is the bonafide work in part fulfillment for the Degree of Master of Science (Speech and Hearing) of the student with register No. M0105.

Mysore
May, 2002

Dr. M. JAYARAM
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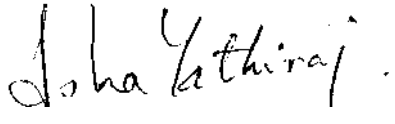
CERTIFICATE

This is to certify that this independent project entitled "HANDOUT FOR AUDITORY MANAGEMENT OF AUDITORY PROCESSING DISORDER" has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier in any other University for the award of any Diploma or Degree.



Mysore
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DECLARATION

This is to certify that this independent project entitled "HANDOUT FOR AUDITORY MANAGEMENT OF AUDITORY PROCESSING DISORDER" is the result of my own study under the guidance of Dr.Asha Yathiraj, Reader and HOD, Department of Audiology, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier at any other University for any other Diploma or Degree.

Mysore
May, 2002

Reg. No. M0105.

DEDICATED TO

The Lord Almighty

for His amazing grace, abundant goodness and loving kindness in my life

&

My Ever-loving family

Amma, Appa & Anna

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I thank the Lord of Heavens for His strength which was made perfect in my weakness.

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INTRODUCTION

"My son, pay attention to what I say;

Listen closely to my words,

Do not let them out of your sight

Keep them within your heart"

-Proverbs

(The Bible)

The above verses suggest that it is not just the hearing sensitivity that is required for encoding information but more higher perceptual processes such as awareness, attention and memory.

Wood (1975, cited in Chermak, 1931) suggested that auditory processing requires a complex series of behaviors that include the ability to do the following:

1. Attend to the content and source of a message
2. Detect and identify the message
3. Transmit the message through the central nervous system for analysis
4. Accurately sort the message on the appropriate perceptual and conceptual levels in order to store and retain the message
5. Retrieve and restore the message for response purposes

A breakdown in any part of the complex auditory and associated systems may result in auditory processing deficits differing in nature and severity. The children diagnosed as having central auditory processing disorders (CAPD)

characteristically manifest hearing sensitivity within normal limits and good speech identification scores in quiet . However parents and teacher may often report that the child is inattentive, fails to follow instructions and does not seen to listen to those around him/her especially in less than ideal listening situations.

The term "central" emerged years ago to differentiate the auditory processing disorders that occurred at the brain stem and cortical levels from those originating in the cochlea or auditory nerve. The other terms used in the past to describe CAPD include central deafness, auditory agnosia, dysacusis, central auditory imperception, auditory processing disorders, central hearing loss, non-sensori hearing loss and obsure auditory dysfuction (Keith, 1999).

Compensatory training or auditory skills development, has been used to strengthen perceptual processes and teach specific academic skills. There are many different approaches to teaching auditory skills that presume to assist the child with a CAPD. Some of these techniques include;

- Speech sound discrimination / Auditory discrimination (Sloan, 1986, cited in Bellis, 1996)
- Auditory closure (Bellis, 1996)
- Auditory memory (Chermak and Musiek, 1997)
- Temporal processing strategies (Tallal et al., 1996, cited in Veale, 1999).

Various studies have been conducted to study the effect of these perceptual training. Merzenich, Johnston, Schrenier, Miller and Tallal, (1996, cited in Veale, 1999) and Taltal et al., (1996, cited in Veale, 1999) have described the positive effects of computer based games that train or modify temporal processing deficits in these children. Merzenich et al. (1996, cited in Gillam, 1999) claimed that these studies strongly indicate that the fundamental temporal processing deficits can be overcome by training.

Although the use of auditory training for CAPD is relatively new, the concept of using auditory training is not new and it dates back to pre-medieval times (Musiek and Berge, 1988). Initially auditory training was used to enable hearing impaired individuals make maximum use of their residual hearing. However since 1960s it has been used in the rehabilitation of individuals, with CAPD.

According to Musiek, Baran and Schochat, (1999) speech perception required involvement of central mechanisms. These central mechanisms are plastic and can be improved with practice. The brain plasticity is the foundation of modern auditory training.

The term "brain plasticity" refers to the phenomenon in which experiences excite individual neurons and influence connections between network of neurons. When multiple experiences occur over time, as it happens during direct training, new neural groups can form, grow and strengthen (Merzenich et al., 1999, cited in Veale, 1999). Changes in the brains of adult monkeys during and after they were trained to process rapidly occurring tactile or acoustic stimuli were examined by Merzenich and Jenkins, (1995, cited in Gillam, 1999) and Recanzone, Schreiner and Merzenich, (1993, cited in Gillam, 1999). They found that connections in monkeys brains could be reshaped through intensive practice that followed strict behavioural training procedures.

Similar plasticity effects have been documented in humans through psychophysical studies by Ahissar and Hochstein, (1993, cited in Gillam, 1999) and through electrophysiological studies by Jirsa (1992). According to Merzenich and Jenkins (1995, cited in Gillam, 1999) intensive training that follow behavioural principles which gradually increases the temporal processing requirements of a task, would result in maximum reorganization of the neural mechanisms that support temporal processing. They further reasoned that these

neurological and perceptual processes should resolve the temporal processing deficits resulting in improved language learning,

Brain plasticity seems to be greater when the animal or human is young. Hence, young brains can change rapidly (Hassamannova, Mysliveceko and Novakova, 1981, cited in Musiek, Baran and Schochat, 1999). According to Chermak and Musiek (1997) and Tallal et al. (1996, cited in Veale, 1999), the system needs to be challenged in an appropriate manner to trigger such changes in structure and function. Tasks that are too easy or too difficult without progression will not yield the improvement that can be obtained from the tasks with moderate difficulty and progress appropriately over time.

Auditory training programs must match the age of the child. Even though central test results often cannot be obtained until 6 or 7 years of age, auditory training can be initiated much earlier.

Aim of the project:

The aim of this project was to develop a handout for the auditory management of CAPD which would include activities to train the different auditory perceptual subskills such as. This project aimed to be used mainly by the professionals concerned with the auditory management of CAPD. The family members and special educators can also carry out these activities under the guidance of speech and hearing professionals.

Need for the development of this handout:

This handout includes auditory training activities for CAPD and the need for the development of this handout is due to several reasons. Research has shown that intensive auditory perceptual training results in the reorganization of neural mechanisms and resolves the temporal processing deficits leading to

improved language learning. Hence, there is a need for the development of the auditory training activities.

There is dearth of materials which gives activities for all the auditory perceptual subskills in a systematic way.

The many readily available auditory training programs make use of computer and other sophisticated instruments which may not be affordable by all the individuals. However, the activities in this handout need no such instruments and yet are very useful for auditory training.

The handout for the auditory management of central Auditory Processing Disorder (CAPD) will be developed based on a review of literature and the experience of speech and hearing professionals. Information regarding the auditory "management of CAPD will be collected from books, journals and the internet. In addition to reviewing the literature, suggestions will be taken from speech and hearing professionals working in the area of CAPD management.

REVIEW

Reports of Central Auditory Nervous System (CANS) dysfunction in adults have appeared in the literature since 1950s (Bocca, Calearo and Cassinari, 1954 ; Bocca, Calearo, Cassinari and Migliavacca, 1955, cited in Chermak and Musiek, 1997). Central Auditory Dysfunction in adults results from identifiable neurologic findings. In children with CAPD there is absence of remarkable neurologic findings which has raised questions regarding the validity of the diagnosis (Cook et al., 1993; Gascon, Johnson and Burd, 1986, cited in Chermak and Musiek, 1997).

Use of the term CAPD with children to describe symptamatology is in use since the late 1960s and 1970s. It was not until a 1977 conference on CAPD in children (Keith, 1977) that this term became prominent and interest in research on paediatric CAPD was stimulated (Manning, Johnson and Beasley, 1977; Martin and Clark, 1977 ; Sweetow and Reddell, 1978 ; Willeford, 1977).

According to ASHA (1996, cited in Chermak and Musiek, 1997), CAPD is not a label for a unitary disease entity but rather a description of functional deficits. These auditory performance deficits associated with CAPD have been well documented by various researchers.

I Deficits Seen in CAPD

The deficits observed in CAPD include auditory performance deficits and metacognitive deficits.

The auditory performance deficits include.

- Deficits in dictiotic listening, selective attention and temporal processing (Chermak, Vonhof and Bendel, 1989; Jerger, Martin and Jerger, 1987).

- Difficulties in Comprehending spoken language in competing speech or noise back grounds (Jerger, Martin and Jerger, 1987; Musiek, Geurkink and Keitel, 1982).

- Performance deficits in understanding verbal directions and auditory memory deficit (Willeford and Burleigh, 1985).

According to Chermak and Musiek (1997) individuals with CAPD have deficient experience processing the auditory signal. This experiential deficit can lead to metacognitive deficits which are described below.

- During a passive or inactive listening task, they fail to attend selectively, organize input, deploy listening comprehension strategies, maintain on-task behaviour or employ task-approach skills, including the ability to focus on relevant task information (Swanson, 1989 , Torgesen, 1979, cited in Chermak and Musiek, 1997).

- They have a passive and inefficient approach to problem solving (Swanson, 1989, Torgesen, 1979, cited in Chermak and Musiek, 1997).

- They have a lack of metacognitive awareness (Paris and Myers, 1981 ; Wiens, 1983).

- Difficulty in monitoring comprehension is present (Bos and Filip, 1982 ; Wong and Jones, 1982),cited in Chermak & Musiek, 1997)..

- They do not activate schematic knowledge, which is the structured cluster of concept and expectations ; an abstract and generic knowledge structure stored in memory that preserves the relations among constituent concepts and generalized knowledge about a text, event message, situation or object (Chermak and Musiek, 1997)

- They do not elaborate and construct information that guides comprehension (Gerber, 1993, cited in Chermak and Musiek, 1997).

Chermak, 1981 has listed the common difficulties associated with auditory processing dysfunction.

1. Communication Difficulties

a) Expression

- Reduced quantity of verbalization
- Inadequate vocabulary
- Defective sentence structure
- Dependence on gestures to express information
- Unusually literal content in ideas expressed.
- Inability to verbalize experiences using a series of words

b) Reception

- Disregard of speech or all sounds
- Better responses- in quiet than in noise
- Hypersensitivity to noise
- Difficulty following verbal directions

- Failure to remember what people say

2. Learning Difficulty

a) Decreased ease, speed and or accuracy

b) Inadequate reading or spelling

- Poor comprehension of what is read
- Disorganization in content of written material
- Discrepancy between verbal and nonverbal scores
- Low scores on verbal tests
- Discrepancy between achievement level and potential for learning
- Difficulty learning from verbal explanation

3. Associated Social-Emotional Behaviours

- Frustration, isolation, aggression, inappropriate emotional reactions, perseveration.
- Immature self-help skills and limited interpersonal relationships.

4. Motor Involvement

- Hyper or hypoactive
- Poor fine and gross motor control (strength, agility, speed).

The above deficits can affect more than one process and there can be overlap of symptoms. The deficits that impede communication will also affect learning and vice versa. These deficits observed in CAPD are presumed to correlate with underlying neurophysiological deficit or neuromaturational differences (Musiek and Gollegly, 1988).

CAPD has been observed in a variety of clinical populations and there are obvious linkages between the symptoms seen in these diverse clinical populations.

II Comorbid Conditions

CAPD has been observed in

1. Individuals with known lesions or pathology of the Central Nervous System (CNS). (eg: Aphasia, Alzheimer's disease, traumatic brain injury).

2. Individuals with suspected or unconfirmed CNS pathology or neuromorphological or neurodevelopmental disorder. eg:- Developmental language disorder, dyslexia, learning disabilities and attention deficit disorder, (Breedin, Martin and Jerger ,1989).

3. Individuals with a history of chronic otitis media (Gravel and Wallace, 1992; Hall and Grose, 1993; Moore, Hutchings and Meyer ,1991).

4. In older adults where neurological changes, albeit not necessarily pathological result from the aging process (Gulya, 1991, Stach, Spretnjak and Jerger, 1990, cited in Chermak and Musiek, 1997).

These conditions are not mutually exclusive and they are characterized as comorbid. Any one disorder cannot be considered as the cause of another disorder. Researchers have noted that the deficits seen in children with CAPD is not the same with all subjects, and they have classified CAPD into different types.

Myklebust (1954) reported that when assessing children with auditory problems a differential diagnosis is necessary because children having different types of auditory problems will vary greatly in their individual needs.

Ill Subprofiles / Types of CAPD

Various subprofiles of CAPD have been developed by different authors taking different aspects into consideration.

The types of CAPD given by Musiek and Gollegly (1988) is based on the assumption that the behaviours observed in CAPD correlate with the underlying neurophysiological deficits or neuromaturational differences. However, Katz, Stecker and Masters (1994) suggested that the categories of CAPD be made up of skills that cluster with specific language and communication deficits. A similar system of categorizing CAPD was introduced by Ferre (1987; 1992, cited in Bellis, 1996). In this system electrophysiological and anatomical data are combined with educational, communicative, behavioural and central auditory processing findings to separate children with CAPD into different categories.

The subprofiles or types of CAPD given by various authors are mentioned below.

1. Subprofile given by Musiek and Gollegly (1988)

They posited three types of CAPDs. This classification is different from other classifications in that here the types of CAPD has been given based on the underlying neurophysiological deficits or neuromaturational differences.

They are:

i) CAPD resulting from neuromorphological disorder

ii) CAPD resulting from maturational delay of CANS

iii) CAPD resulting from neurologic disorders, diseases and insults

The importance of this classification is that the intervention can be customised based on the current understanding of the underlying differences in etiology and brain function which relate to the patient's age, linguistic and cognitive competencies.

2. Subprofile given by Katz, (1985, cited in Bellis, 1996)

He derived four categories of CAPD based on Staggered Spondaic Word (SSW) test signs. The four categories are:

i. Decoding Category
ii. Tolerance Fading memory
iii. Integration Category
iv. Organization Category

The decoding category attempts to isolate auditory processing that breaks down at the phonemic level. Tolerance-Fading memory focuses on two symptoms that are found together i.e. difficulty understanding speech in a background of noise and a rapidly fading memory. The patients with integration disabilities display difficulty in bringing information together. Individuals under organization category have difficulty maintaining sequence and in organizing information.

In 1992, Katz gave the Buffalo model, in which the authors separated CAPD into four categories. These four categories were similar to that given by Katz in (1985, cited in Bellis, 1996) except that the categories were made based on skills that cluster with specific language and communication deficits.

3. Classification given by Bellis and Ferre, (1996, cited in Bellis, 1996)

Ferre (1987; 1992, cited in Bellis,1996) introduced a system to classify CAPD. This system was expanded by Bellis and Ferre (1996, cited in Bellis, 1996). In this model electrophysiological and anatomical data are combined with educational, communicative, behavioural and central auditory processing to separate children with CAPD into the following four categories or sub profiles:

i. Auditory Decoding Deficit
ii. Integration Deficit
iii. Associative Deficit
iv. Organization output Deficit

The categories made by Bellis and Ferre (1996, cited in Bellis, 1996), Katz (1985, cited in Bellis, 1996) varies in just one subcategory. Both the classifications include the categories of decoding, integration and organization. The classification given by Katz (1985, cited in Bellis, 1996) includes Tolerance Fading Memory as a subcategory while that given by Bellis and Ferre (1996, cited in Bellis, 1996) includes associative deficit.

The importance of subprofiling CAPD or classifying CAPD into different types has been given by Myklebust (1954). He reported that when assessing children with auditory problems, a differential diagnosis is necessary because children having different types of auditory problems will vary greatly in their individual needs. According to Katz (1992) the use of subprofiles of CAP deficits has begun to gain wider acceptance clinically.

In order to classify the individuals with CAPD into different categories, various assessment procedures are used. These are also used to differentially diagnose CAPD from other disorders which share similar symptoms. These

disorders include learning disability (LD), Attention Deficit Disorder (ADD) and Attention Deficit and Hyperactive Disorder (ADHD).

IV Assessment

According to Bellis, (1996) a multidisciplinary team approach to CAPD identification should be implemented. There are several members in the CAPD team who have varied responsibilities. They include :

i. **Audioiogist**

These professionals would be involved in managing and co-ordinating CAPD effort and perform audiological evaluation to rule out peripheral hearing loss.

ii. Speech Language Pathologist

Their role is to define the child's receptive and expressive language skills as well as written language and associated abilities.

iii. Educator

They provide information regarding a child's listening and learning behaviour in the classroom.

iv. Psychologist

They determine a child's cognitive skills and capacity for learning.

v. **Parents**

They prove information regarding developmental milestones, auditory behaviour in the home and medical and academic history.

vi. Physician

Their role is to rule out presence of pathology that may affect learning abilities.

The assessment of CAPD includes nonaudiological assessment and audiological assessment.

Nonaudiological Assessment

According to Willeford and Burleigh, (1985) the nonaudiological assessment instruments are employed primarily by speech-language pathologists and other professionals and are viewed from a perspective of assessing the auditory aspect of language performance.

Numerous tests have been developed in an attempt to measure the theoretical functions that comprise auditory perception. Various authors have divergent concepts of what is entailed in the process of audition and hence the commercially available tests have very different concepts and formats.

The table 1 lists the nonaudiological that are used in assessing various deficits associated with CAPD.

Table 1: Nonaudiological tests used to assess CAPD

AUDITORY PROCESS	TESTS (NONAUDIOLOGICAL)
i) Auditory Discrimination	1. Lindamood Auditory conceptualization Test. (Lindamood and Lindamood, 1971, cited in Barr, 1976) 2. Goldman-Fristoe-Woodcock (GFW) Auditory

	Discrimination Test (Goldman, Fristoe, and Woodcock, 1970, cited in Heasley, 1980) 3. GFW Diagnostic Auditory Discrimination Test. (Goldman, Fristoe and Woodcock, 1974, cited in Heasley, 1980) 4. Composite Auditory Perceptual Test. (Butler, Hedrick and Manning, 1973, cited in Willeford and Burleigh, 1985) 5. Auditory Discrimination Test (Wepman, 1958, cited in Willeford and Burleigh, 1985) 6. Differentiation of Auditory Perceptual skills. (Reagan and Curringham, 1976, cited in Bellis, 1996) 7. Test of Auditory Perceptual skills (Gardner , 1963, cited in Bellis, 1996) 8. Auditory Discrimination Test (Reynolds, 1987, cited in Bellis, 1996) 9. Carrow Auditory Visual Abilities Test (Carrow - Woodfolk, 1981, cited in Bellis, 1996)
ii) Auditory Vigilance (Sustained Attention)	1. Lindamood Auditory Conceptualisation Test (Lindamood and Lindamood, 1971, cited in Barr, 1976)

	2. Composite Auditory Perceptual Test (Butler, Hedrick and Manning, 1973, cited in Willeford and Burleigh, 1985)
iii) Auditory Memory	1. Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, Kirk, 1968, cited in Barr, 1976). 2. Goldman-Fristoe-Woodcock Auditory Memory Test (Goldman, Fristoe, Woodcock, 1974, cited in Heasley, 1980) 3. Composite Auditory Perceptual Test (Butler, Hedrick and Manning, 1973, cited in Willeford and Burleigh, 1985) 4. Differentiation of Auditory Perceptual Test (Reagan and Cunningham, 1976, cited in Bellis , 1996) 5. Test of Auditory Perceptual skills (Gardner, 1985, cited in Bellis, 1996) 6. Carrow Auditory Visual Abilities Test (Carrow-Woodfolk, 1981, cited in Bellis, 1996) 7. Auditory Sequential Memory Test (Wepman and Morency, 1973, cited in Bellis, 1996)
iv) Auditory Sequences	1. Illinois Test of Psycholinguistic Abilities. (Kirk et

	al, 1968, cited in Barr, 1976) 2. Lindamood Auditory Conceptualization Test (Lindamood and Lindamood, 1971, cited in Barr, 1976) 3. Goldman - Fristoe - Woodcock Auditory Memory Test. (Goldman, Fristoe and Woodcock, 1974, cited in Heasley, 1980) 4. Composite Auditory Perceptual Test (Butler, Hedrick and Manning, 1973, cited in Willeford and Burleigh, 1985) 5. Carrow Auditory Visual Abilities Test (Carrow - Woodfolk, 1981, cited in Bellis, 1996) 6. Auditory Sequential Memory Test (Wepman and Morency, 1973, cited in Bellis, 1996)
v) Auditory Closure	1. Illinois Test of Psycholinguistic Abilities (Kirk et al, 1968, cited in Barr, 1976) 2. GFW Auditory Selective Attention Test (Goldman, Fristoe, Woodcock, 1974, cited in Heasley, 1980) 3. Flowers-Costello Tests of Central Auditory Abilities (Flowers, Costello and Small, 1970, cited in Bellis, 1996) 4. Composite Auditory Perceptual Test (Butler,

	Hedrick and Manning, 1973, cited in Willeford and Burleigh) 5. Differentiation of Auditory Perceptual skills (Reagan and Cunningham, 1976, cited in Bellis, 1996) 6. Carrow Auditory Visual Abilities Test (Carrow - Woodfolk, 1981, cited in Bellis, 1996)
vi) Fracturing Ability	1. GFW Sound Symbol Test (Goldman, Fristoe and Woodcock, 1974, cited in Heasley, 1980) 2. Composite Auditory Perceptual Test (Butler, Hedrick and Manning, 1973, cited in Willeford and Burleigh, 1985)
vii) Auditory Contour Recognition	1. Differentiation of Auditory Perceptual skills (Reagan and Cunningham, 1976, cited in Bellis, 1996)

Audiological Assessment

According to Willeford and Burleigh (1985) audiological tests of central function minimize the dependence on linguistic talents and exercise the necessary test protocols that will permit assessment of the balance and strengths of the Central Auditory Nervous System (CANS).

Audiological central auditory tests have been used primarily with adults for medical purposes to help confirm the presence and site of lesions in the CANS. However, such tests are employed with children, to assess the functional proficiency of their CANS and with concern for its consequent effect on the

development of academic, social and communication skills. Thus, the goal is to administer tests that will uniquely stress the auditory mechanisms at various levels of the central nervous system (CNS), with the objective of identifying deficiencies in an inefficient system.

Such stress is created by special test design that requires more complex response in the higher auditory centers. These responses would be more complex than responding to the awareness of a simple pure tone or recognizing or repeating single spondaic or monosyllabic words. Audiologists have successfully used with children a variety of central auditory tests that fall into four classifications.

1) Tests in which speech stimuli are presented monotically (one ear at a time), including patterned or distorted verbal messages, messages that are embedded in competing signals, and pattern sequencing tasks with tones, the latter being a notable exception to the use of speech.

2) Tests that present stimuli in a dichotic paradigm (different signals presented to the two ears at the same time)

(3) Tests that require the listener to sequence or sum complementary signals that are spatially separated in the two ears.

(4) Electrophysiologic tests that objectively measure the physiologic response to auditory stimulation.

There are various tests under each of these headings, a few of these tests are mentioned below.

1. The monotic tests include:

a) Frequency limited (filtered speech) (Bocca, Calearo and Cassinari,1954, cited in Silman and Silverman, 1991).

b) Time alterred (compressed speech) (Fairbanks, Everitt and Jaeger, 1954, cited in Bellis, 1996)

c) Pattern recognition (frequency) (Pinheiro and Ptacek, 1971)

d) Performance-intensity function

e) Ipsilateral competing signals (Speech Vs. speech or noise) (Jerger and Jerger, 1974)

2. The dichotic tests include

a) Competing digits (Kimura, 1961, cited in Silman and Silverman, 1991)

b) Competing words (Consonant- vowel, consonants, spondees) (Katz,1962)

c) Nonsense sentences Vs.discourse (Jerger and Jerger, 1974)

d) Real sentence Vs. real sentences (Fifer , Jerger, Berlin, Tobeyand Campbell, 1983)

e) Competing consonant -vowels (Berlin ,Lowe-Bell, Janetta and Kline, 1972)

3. The Binaural Interaction tests include:

a) Binaural fusion (Wilson, Arcos and Jones, 1984)

b) Rapidly alternating speech (Willeford and Bilger, 1978)

c) Masking level differences (Wilson, Zizz and Sperry, 1994, cited in Bellis, 1996)

4. The electrophysiological tests include:

a) Aural reflex test (Borg, 1973, cited in Simian and Silverman, 1991)

b) Brainstem evoked response (Jewett and Williston, 1971)

c) Cortical evoked response (Mcpherson, 1995)

The above mentioned audiological tests of CANS function are occasionally criticized as being insensitive for identifying auditory processing problems exhibited in real life. According to Chermak and Musiek (1994) the reliability of central tests may be difficult to determine using a population of subjects with CAPD due to the dynamic nature of central disorders as well as to the high degree of variability among these subjects.

Different authors have categorized the tests of central auditory function in different ways. Baran and Musiek (1991) categorized the central tests into

a) Dichotic speech tests
b) Temporal ordering tasks.
c) Monaural low-redundancy speech tests.
d) Binaural interaction tests.

Each of the above categories has several tests. Bellis (1996) has given a list of these tests (Table 2).

Table 2: Audiological test used to assess CAPD (Bellis, 1996)

CENTRAL AUDITORY TESTS	PROCESSES ASSESSED
I. Dichotic Speech Tests.	
1. Dichotic Digits (Kimura 1961 a, Revised by Musiek, 1983a)	Binaural Integration
2. Dichotic Consonant - Vowels (Berlin et al., 1972)	Binaural Integration
3. Staggered Spondaic Word Test	

(Katz, 1962)	Binaural Integration
4. Competing Sentences Test [Developed by Willeford in 1968, (Willeford and Burleigh, 1994)]	Binaural Separation
5 Synthetic Sentence Identification Test with Contra lateral Competing Message. (Jerger and Jerger, 1974; Jerger and Jerger, 1975)	Binaural Separation
6. Dichotic Sentences Identification Test.(Fifer,Jerger, Berlin, Tobey and Campbell, 1983)	Binaural Integration
7. Dichotic Rhyme (Wexler and Hawles, 1983)	Binaural Integration
II. Temporal Tests	
1. Frequency Pattern Test (or) Pitch Pattern Sequence Test (Pinheiro and Ptacek, 1971; Ptacek and Pinheiro, 1971)	Frequency Discrimination, Temporal ordering, Linguistic Labeling
2. Duration Pattern Test (Pinheiro and Musiek, 1985)	Duration Discrimination, Temporal Ordering, Linguistic Labeling
3. Psychoacoustic Pattern Test (Blaettner etal., 1989)	Temporal Discrimination

III. Monaural Low-Redundancy Speech Tests	
1. Low-Pass Filtered speech (Bocca, and Calearo and Cassinari, 1954)	Auditory Closure
2. Time Compressed Speech (Fairbanks, Everitt and Jaeger, 1954)	Auditory Closure
3. Time Compression plus reverberation. (Wilson, Preece, Salamon, Sperry and Bornstein, 1994)	Auditory Closure
4. Synthetic Sentence Identification With Ipsilateral Competing Message. (Jerger and Jerger, 1974; 1975 a)	Auditory Closure
5. Speech-in-Noise [Olsen, Noffsinger and Kurdziel, 1975; Sinha (1959)]	Auditory Closure
IV.Binaural Interaction Tests	
1. Rapidly Alternating Speech Perception (Willeford and Bilger, 1978)	Binaural Interaction
2. Binaural Fusion Test (Band Pass Filtered), (Matzker, 1959)	Binaural Interaction

3. Binaural Fusion (Consonant - Vowel - Consonant), (Wilson, Arcos and Jones, 1984)	Binaural Interaction
4. Interaural Just Noticable Differences. (Pinheiro and Tobin, 1969; 1971)	Binaural Interaction

There is controversy regarding whether electrophysiological measures should be a part of central auditory assessment. According to Bellis (1996) depending on the situation such as in cases where objective evidence of auditory processing dysfunction is necessary for special education classification, legal documentation etc., electrophysiological tests may be useful to provide the objective data.

From the above it is evident that different tests are useful for providing information about various auditory processes. Hence, while evaluating an individual for CAPD a test battery approach should be followed which incorporates different tests to assess the different auditory processes.

The assessment can be done in different ways and it can be either formal assessment or informal assessment. The test that were mentioned earlier ie., both the nonaudiological and the audiological are a part of the formal assessment. According to Bloom and Lahey (1978), formal assessment is conducted prior to intervention so that the remediation program commences with the most appropriate and reasonable goals and procedures for improving the deficient behavior.

Informal assessment is where information is gathered by observing an individuals attending behavior. According to Chermak (1981), an individual's direction following ability, the number of directions followed, the linguistic complexity of the directions followed and speech intelligibility should also be observed.

The main goal of assessment is to identify the areas of deficit so that suitable management programs and remediation activities can be given to the individual. The assessment will continue even during remediation in order to chart progress, establish new goals and make necessary changes in the procedure. However, the primary objective of auditory processing remediation is to improve communication by maximizing the contribution of the auditory system. There are different remediation approaches and various therapy techniques, which have been explained below.

V Management of Auditory Processing Dysfunction

There are various approaches for the remediation and management of central auditory processing deficits. Chermak (1981) has given the following four basic approaches:

1. Traditional direct approach
2. Supportive services and counseling
3. Experiential-Linguistic approach
4. Psychoacoustic or molecular approach

These approaches have been explained below:

/. *Traditional Direct Approach*

This approach emphasizes on the assessment and remediation of an individual's auditory processing skills such as memory, attention, discrimination etc.

Eg:- If the individual has deficiency in areas of selective attention and auditory memory, then the remediation program is designed to focus on these particular skills.

Although this approach appears logical, it's validity is questionable. The client may manifest progress in the specific skill areas being remediated and tested , however the carryover to broader kinds of learning is uncertain (Lesner, 1976, Cited in *Chermak 1981)* .

2. Supportive Services and Counselling

Willeford and Bilger (1978) suggested a remediation program that involves counselling the child, family and educational personnel concerning the nature of auditory processing problems and controls for coping with the auditory world. According to the authors carryover in the form of improved communication skills, better grades and heightened self-esteem may result from this approach. However carefully controlled research must be conducted to ascertain the reality of this expectation.

3. Experiential — Linguistic Approach

This approach advocated by Ling, (1978) emphasises on active communication within realistic and meaningful contexts. Even though some time is spent in developing the individual's auditory processing skills as in the "Traditional Direct Approach", most of the time is aimed at developing a

mobilization toward auditory stimuli and the successful incorporation of these stimuli into communicative and academic endeavors. It is felt that through proper counselling and the provision of realistic and meaningful experiences that demand good listening skills, the child presenting deficient auditory skills will benefit in terms of better communication skills, improved academic function and enhanced self-image.

4. Psychoacoustic or molecular Approach

Auditory processing remediation conducted within the framework of the Psychoacoustic (Molecular) approach focuses on the skills delineated by Mazeas (1972). Remediation activities resolve around attempts to improve the client's detection of frequency, intensity and time differences. Research remains to be conducted to ascertain the effectiveness of this procedure in terms of carryover to linguistic and academic success.

STATEGIES / TECHNIQUES

The traditional approaches use several strategies / techniques to enhance auditory processing skills in individuals with CAPD. The following are the strategies and techniques that have been used for various auditory processing deficits. The various strategies and techniques and the specific auditory processing deficit for which they are used and how they are used is given below.

I) Awareness of Sound

Individuals with deficit in auditory awareness will be insensitive to all kind of sounds.There are various therapy programs, which aim at improving the individual's awareness of sound.

/. Barry's Program:

Barry (1961) approaches awareness training as a three-phase process. The three phases are

a) Awareness of gross sounds where a motor response is solicited to frequency differences in the sound of a bell, drum, whistle and horn.

b) Awareness of finer sounds where beads are dropped into a tin, pebbles are rattled in a box, coins are jangled and a spoon is stirred in a cup.

c) Awareness of voice and speech where the child gives a motor response to digits, words, phrases and nonsense syllables, (cited in Barr, 1976).

2. Sensory Integration Therapy

The concept of Sensory Integration (SI) was developed based on studies by Jeanne Ayres (Mauer, 1999). The SI therapy is useful for children with sensory integrative dysfunction who also have difficulty with auditory processing. The original definition of SI was the ability to organize sensory information for use (Ayers, 1972, cited in Mauer,. 1999). Later in 1979, Ayres elaborated the definition as follows: "Sensory Integration is the neurological process that organizes sensation from one's own body and from the environment and makes it possible to use the body effectively within the environment. The spatial and temporal aspects of inputs from different sensory modalities are interpreted, associated and unified. SI is information processing which the brain must select, enhance, inhibit, compare and associate the sensory information in a flexible constantly changing pattern; in other words the brain must integrate it" (cited in Mauer, 1999).

According to Ayres (1979, cited in Mauer, 1999) SI intervention are based on the premise that plasticity exists within the Central Nervous System (CNS).

Usually SI develops in the course of ordinary childhood activities without effort. Visual and auditory processes are considered to be the end products of many more fundamental aspects of the brain. For some children however these processes are inefficient demanding effort and attention with no guarantee of accuracy.

The goal of SI therapy was to improve the way the brain processes and organizes sensations. Based on the principle that the brain functions as an integrated whole but is made up of systems that are hierarchically organized, the primary goal of SI therapy is to provide the child with sensory information that will assist in organizing the vestibular, tactile and proprioceptive systems so that he or she can develop higher functioning abilities such as attention, language interaction and motor abilities.

Traditional SI therapy is narrowly defined as more than a collection of sensory stimulation activities (Ayres 1979, cited in Mauer, 1999). It involves the use of enhanced, controlled, sensory stimulation in the context of a meaningful, self-directed activity in order to elicit an adaptive behaviour. (Koomar and Bundy, (1991, cited in Mauer, 1999) report that the important characteristics of SI therapy include the client's self selection of activities, individualized treatment based on the client's characteristics of sensory integrative dysfunction and appropriately graded levels of challenge.

A child who exhibits difficulties in sensory modulation is helped to respond in a more adaptive way to sights, sounds, touch and movement experiences (Parham and Mailloux, 1996, cited in Mauer, 1999).

Clinical reports have found significant changes in behaviour during and after therapy, including improved ability to organize responses to the physical

environment (Humphries, Wright, Snider and McDougall, 1992, cited in Mauer, 1999).

3. Visco Developmental Training Program (VDTP)

Etten and Watson (1977) has described a four-year program developed by Visco. This focusses on the development of auditory perception using nonverbal auditory stimuli.

The program, which is divided into two units is designed for students in kindergarten through third grade. Unit 1 is divided into 64 lessons while unit 2 contains 70 lessons. Each unit has seven levels of nonverbal-auditory perception (which are developed by training three basic areas of responses). The seven levels represent a hierarchy of development according to Visco. The seven levels are:

a) Attention to auditory stimuli
b) Sound versus no sound
c) Sound localization
d) Discriminating between sounds
e) Discriminating sound sequences
f) Auditory figure ground
g) Associating sound sources

This hierarchy assumes that each, task builds on the next and that mastery of each step of the developmental sequence is necessary to accurate processing of the auditory stimuli.

The above levels are elicited by three types of responses, i.e. listening, telling and sensorimotor. In unit 1, the first mode of response required is

listening, which is not an overt response and the children should respond by telling, singing or saying. In Unit 2, a worksheet provides the children with a visual stimulus. The auditory stimulus is presented and the children must match the correct auditory stimulus with the visual stimulus.

According to, Etten and Watson (1977) the positive feature of this program is the worksheets. They contain large clear illustrations in an uncluttered format. There are often only three or four lines per page with no more than five stimulus items per line. This helps assure that the primary efforts can be directed toward solving the auditory problems, rather than making the child sift through a complicated visual display.

II) Auditory Localisation

An individual with deficit in auditory localization will not be able to identify the direction from which a sound or series of sounds originated. There are a few therapy programs which have activities to improve auditory localization and they are explained below.

/. Kottler's Program

In this program Kottler (1972, cited in Barr, 1976) presents activities for rehabilitating children with auditory localization, sound discrimination and sound sequencing deficits. He discusses each of these three areas in terms of the learning difficulties involves, prerequisite skills and whether tests are available to assess each perceptual area.

Class activities and games designed to train students in each auditory skill are discussed. Activities for sound localization progress in difficulty from stationary child to sound, to stationary child and moving sound, to moving child and stationary sound.

2. Visco Developmental Training Program (VDTP)

One of the seven levels of nonverbal auditory perception which this program aims at training is auditory localization. The auditory localization responses are elicited by working on 3 basic areas of response, i.e. listening, telling and sensorimotor (Etten and Watson, 1977).

III) Auditory Vigilance

Auditory vigilance refers to sustained attention. Individuals with auditory vigilance deficit will fail to detect the target stimulus in a continuous stream of auditory stimuli. The individuals also show false positive errors by responding to a stimulus other than the target stimulus (Bellis, 1996).

There are different therapy programs, which include activities to develop the auditory vigilance, i.e. the sustained attention of an individual with CAPD. These therapy programs have been explained in the following section.

/. *Auditory Perceptual Training Program*

Butter, Hedrick and Manning developed the auditory Perceptual Training Program (APT), 1973.

A promotional brochure for this program reports that it is applicable primarily to students in grades one to three, or learning disabled students through grade six, who do not know how to pay attention, who are easily distracted by classroom noise, who have trouble recognizing voices, hearing differences between sounds and understanding or remembering what they hear.

This remediation plan is intended for children who have learning or reading problems related to inadequate or faulty processing of auditory information. If a child fails the Composite Auditory Perceptual Test, the authors

recommend this twice - a-week program. This remediation program includes 39 tape recorded lessons that are divided into four basic units that include exercises such as:

1. Listen for sounds - selective listening, vigilance, temporal sequencing, speech sound discrimination and analysis,
2. Listen for words and speakers-intonation patterns, voice identification, temporal sequencing, auditory closure and auditory synthesis.
3. Listen to remember-recognition of the number of sounds and syllables in words and phrases and figure-ground discrimination through competing messages.
4. Listen to learn-more difficult competing messages and recognition of subject-verb agreement, active and passive voice and complex syntactical structures.

The authors report that after training with this program, the child will be able to process auditory information more efficiently.

Though the authors have expressed that the program was extensively researched and field-tested on over 1500 children, no documentation is provided to support the contention that improvement, if any, is the result of the program rather than that of maturation or of other factors (Willeford and Burleigh 1985).

2. Semel Auditory Processing Program, (SAPP) (Semel, 1976)

This was developed in 1976 to help teachers remediate auditory processing disorder that relate to skills involved in reading cognition and communication (Semel, 1976, cited in Willeford and Burleigh, 1985). Semel stated that "Auditory training to awaken the child's potential is directed towards releasing the accumulated store auditory information and ability that auditory

information and ability that was never properly developed. This type of training is ordinarily accomplished through feeding the brain sequential ordered micro-units of auditory configuration patterns" (Semel; 1976, cited in Willeford and Burleigh, 1985).

Semel also advocates teaching the child to listen to what he/she hears. Auditory attention is directed to the localization of sound. The child is shown how to recognize, focus on, discriminate, memorize, categorize, integrate and synthesize the various patterns of all parts that are essential to the total auditory process. The primary emphasis of SAPP involves the identification of target sounds in various words. Semel's philosophy is that a central auditory processing problem can be treated by working primarily on speech-sound identification.

Beginning, intermediate and advanced levels of this program have differences in difficulty but all concentrate on listening to initial and final consonants, vowels and blends.

Though the question remains whether this task would aid a child with CAPD in his/her daily complex auditory environment, a study done by Semel and Wiig, (1981) are there more studies showed that there were significant gains in auditory attention span for unrelated words and related syllables using this program.

3. Visco Developmental Training Program

Auditory attention is one of the seven levels of nonverbal-auditory perception besides auditory awareness and auditory localization which have been identified by Visco for training in this program, which was described by Eten and Watson (1977).

There are seven levels in this program which represent a hierarchy. This hierarchy assumes that each task builds on the next and that mastery of each step of the developmental sequence is necessary to accurate processing of the auditory signal. This program assumes that the child should be able to attend to auditory stimuli before he can discriminate between sounds The response modes used are similar to what is used while training for auditory awareness. This procedure requires the child to focus his attention on the last thing he hears. However, this procedure has been criticized since most of the children have difficulty in processing on the last thing they hear.

4. Sensory Integration Therapy (SIT)

This therapy besides being useful for improving the auditory awareness is also useful in developing sustained attention of children with CAPD. Sensory integration therapy is useful for children with the inability to maintain an appropriate state of alertness through ordinary activities as well as to focus and attend to a task (Mauer, 1999).

According to Ayres (1979, cited in Mauer, 1999), the primary goal of SI therapy is to provide the child with sensory information that will assist in organizing the vestibular, tactile and proprioceptive system so that he or she can develop higher functioning abilities such as attention.

Speech-Language pathologists are encouraged to incorporate language into movement activities, (e.g. develop a verbal cueing system for motor planning of an obstacle course activity). The purpose of this activity is to facilitate the child's sensory processing and improve arousal and attention to the task, language and organisation, resulting in increased speech production and understanding of language.

Improved auditory attention i.e., increased ability to attend to the task following SI therapy has been reported by deQuiros (1976); Rosenwinkel, Kleinert, Robbins (1980 , cited In Mauer,1999) .

5. *Auditory Integration Training (AIT)*

Early work on AIT was done in France by the otolaryngologists Berard and Tomatis and in Canada by Binet, as reported by Madell (1999).

Berard (1993), reported that distortions in the auditory system (peaks and valleys in the audiogram) could produce problems in behaviour and cognition. Threshold differences between adjacent frequencies of 5 dB was considered to be significant.

Berard reported that AIT strengthened middle ear muscles, which then improved the person's ability to respond to loud sound. Another theory is that the stimulus used in AIT (music modulated in a random, unpredictable way) stimulates an area of the reticular activating system (locus coeruleus and lateral tegmental area). The reticular activating system receives input from vestibular and auditory pathways. It contains neurotransmittors, which have a role in arousal, alerting, motivation, emotion, memory and reorganization (Cool and Farber, 1990, Frick and Lawton - Shirley 1994, cited in Madell, 1999).

The AIT involves listening to music with those frequencies that results in hyperacquity filtered out. The auditory system reacts to this therapy by adjusting the totality of the frequencies heard. Thus, the audiometric curve tends to flatten and hearing is normalized maintaining the former frequency differentiations but eliminating the hyperacute areas.

The outcome of AIT includes reduction in sound sensitivities (Rimland and Edelson, 1994, cited in Madell, 1999) and reduction in behaviour problems

etc. (Cortex - Mcker

and Pankseep, 1993, Creedon, Edelson and Scharre, 1994, cited in Madell, 1999)-

Another important area in which changes are observed auditory attention. According to Keith (1999), many parents and teachers report that children have better attention, less difficulty understanding in the presence of noise and an increased rate of language learning after AIT.

There are however, a few reports of limited or no benefit from AIT. Yencer (1998, cited in Tharpe, 1999) studied the effectiveness of AIT on children diagnosed with CAPD and he concluded that no treatment effects were observed on auditory measures or behavioural questionnaires when placebo control groups were employed.

6. Auditory continuous Performance Tasks

Vigilance is trained using those procedures employed in auditory or visual continuous performance tasks. (Keith, 1994, Lindgren and Lyons, 1984, Sergeant and Van der Meere, 1990, cited in Chermak and Musiek, 1997). The client is required to sustain attention to a continuous stream of auditory stimuli, such as environmental sounds, syllables, or words and to respond (eg: raising a hand, tapping the table) when a particular stimulus is heard. Failure to detect the target stimulus reflects in attention.

False positive errors i.e. responding to a stimulus other than the target stimulus may reflect impulsivity. Auditory continuous performance tasks along with appropriate reinforcement strategies may help in improving attention span.

7. *Earobics*

This programme has been developed by Cognitive Concepts Incorporation. Earobics is one of the leading solution for providing explicit comprehensive phonological awareness and auditory processing training for the prevention and remediation of reading and other language based disabilities in children aged between 4-7 years. (Cognitive Concepts Inc.,1997-2000).

There are 6 games and they work on different auditory perceptual subskills. The games Karloon's Balloon, C.C. Coal Car, Rap-A-Tap-Tap, Rhyme time, Caterpillar connection, Basket full of eggs work on auditory attention.

8. Fast ForWord®

Fast ForWord® is one of the learning intervention options that are designed to improve language skills by targeting specific auditory abilities such as temporal processing or the ability to process sound segments as they occur sequentially in time (Scientific Learning Corporation, 1998).

Fast ForWord® is a computer software program that has been designed to build skills that children with language learning impairment need for listening, speaking and reading.

The Fast ForWord® computer games incorporate acoustically modified speech in exercises to improve language decoding skills of children with language learning impairments by helping them to discriminate subtle sound differences. The games are designed to train children with language impairment to process sounds and words at increasing rates of presentation until they are able to discriminate and follow directions that are presented at the typical rate of conversational speaking.

An additional purpose of several games is to build phonological awareness a skill that Scientific Learning Corporation also suggests is necessary for must children in learning to read.

The Fast ForWord® program consists of seven computer games. Clients play five games each day as automatically determined by the software. A total of 100 minutes of game play per day is necessary. When the child has demonstrated mastery of skills necessary for the firstlevel of the game for several successive turns, the software automatically advances the child to the next level. The child's performance is continually monitored and saved by the program so that the level of game play is both challenging and reinforcing.

The suggested criterion for finishing the Fast ForWord® is completing at least 80% (or reaching Level 5 game play) on five of seven of the games. Time for completion differs from child to child but is usually within the 4 to 8 week range.

Upon finishing the protocol, the software license expires and the software is returned to the provider. According to Veale (1999) speech, language pathologists, teachers, and parents report increase in overall language abilities including auditory processing speed, working memory, phonological awareness, listening and comprehension skills and syntax usage. Children who have completed the protocol are described as being more focused and attentive and more involved in class activities and they appear to have increased self-confidence and fewer behavior problems. (Scientific Learning Corporation, 1999).

According to Gillam,(1999) extensive scientific studies have yet to substantiate the claim that improvements in language measures can be validated several months after the intervention.

IV) Auditory Closure

It is defined as the ability to utilise extrinsic and intrinsic redundancy to fill in missing portions of auditory signals and recognise the whole message. Deficit in auditory closure will lead to difficulty in understanding speech in background noise or with unfamiliar speakers (Bellis, 1996).

Different strategies such as increasing signals to noise ratio and using contextual cues have been used to improve auditory closure. Different therapy programs are available which work on the auditory closure ability. Auditory closure activities are just one of the several activities that are suggested in each of the programs.

1. Auditory closure Activities (Bellis, 1996)

According to Bellis, the purpose of auditory closure activities is to fill in the missing parts in order to perceive a meaningful whole. Context also plays an important role in auditory closure, since prediction of the complete word or message often depends on the surrounding context.

The activities are presented in a sequential fashion from least to most difficult and the child should demonstrate mastery of the activities of one level before moving on to the next. The activities suggested by her include:

(i) Missing Word Exercises:-

These exercises are designed to teach the child to use context to fill in the missing word in a message. The exercise should begin with very familiar subject such as rhymes and then more on to new information. Initially the child may be asked to listen to a rhyme and to predict the missing part.

Eg. Twinkle twinkle little <u>(star)</u>

A slightly higher level activity is prediction of rhyming words. Eg: Animal that rhymes with house (mouse).

Once these steps have been mastered the clinician moves on to new unfamiliar messages in which the child must utilise the context of the phrase, sentence or paragraph.

Eg. When I am hungry, I (eat).

ii) **Missing syllable Exercises**

Once the child can predict a missing word based on context the clinician can move on to the omission of syllables. The clinician may begin with sentences in which the target word is embedded

(Eg: There are 26 letters in the Alpha——(bet).

Then the clinician can move on to single words in which the only contextual cue may be a category designation. Eg:- sports (Base (ball), Soc (cer), Ten (m's).

iii) Missing Phoneme Exercises:

Exercise in which specific phonemes are committed can be carried out in a similar fashion to the missing syllable exercise. The child should supply the missing phonemes in word with contextual clues.

Eg: I like to (W)atch (T)ele (V)isioin.

According to Bellis (1996), through repeated drills such as these, the child learns to become less independent on hearing and decoding every component of the target word and more aware of the need for contextual derivation when the complete acoustic signal is inaccessible.

2. Auditory Perceptual Training program:- (Butler, Hedrict and Manning, 1971)

This program includes 39 tape-recorded lessons that are divided into four basic units which include exercises for listening, auditory closure besides activities for selective listening, auditory discrimination etc. (cited in Willeford and Burleigh, 1985). The exercise for auditory closure is included in the unit, "Listen for words and speakers". According to the authors who developed this program, after training with this program, the child will be able to process auditory information more efficiently.

V) Auditory Discrimination:

There are many types of auditory discrimination. They are

a) Intensity Discrimination

b) Frequency Discrimination

c) Tone-glide Discrimination

d) Temporal gaps Discrimination

e) Temporal order Discrimination

f) Vowel - sound Discrimination

g) Consonant sound

h) Multiple choice word

i) Auditory discrimination under conditions of noise.

Individuals with deficits in intensity discrimination will not be able to discriminate intensities.

Inability to discriminate frequency differences of 5-10 Hz will be seen in individuals with frequency discrimination deficit.

Tone - glide discrimination deficit will be characterized by an impairment in discriminating the upward or downward direction of a frequency sweep for tone bursts of a few milliseconds.

Difficulty in discriminating duration of gaps between two consecutive noise is the symptom seen in individuals with temporal gap discrimination deficit.

Individuals whose temporal order discrimination abilities are affected will have difficulty in discriminating whether the tone sequences are same or different (Bellis, 1996). There are different auditory training programs to work on the auditory discrimination abilities. They are:

/. Auditory Discrimination in Depth (ADD) program:-

The ADD program developed by Lindamood and Lindamood (1969) was devised for developing the function of the ear in monitoring the correspondence between the contrasts, sequences and shifts of our spoken language and the sets of graphic symbols which represent them (cited in Willeford and Burleigh), 1985).

This program includes four levels of activities.

i) Gross Levels:- This includes activities geared to problem solving techniques and the gross discrimination of sounds,

ii) Oral-Aural Level:- Pertaining to the teaching of auditory discrimination of sounds, consonant or vowel changes in syllable patterns and changes in syllable combinations.

iii) Sound symbol level: here the child taught to recognize phonemes.

iv) Coding level: coding of nonsense syllables into graphic and oral patterns and generalization into words is done here.

The primary goal of this program is to help the child encode and decode multi-syllabic nonsense patterns until the student has achieved competency with real words (Lindamood and Lindamood, 1969 ,cited in Barr, 1976).

The ADD program is recommended as a precursor for any speech or reading program and is appropriate for anyone, from pre-schoolers to adults. Thr length of the time that the individual is enrolled in this program varies according to the students progress. The average amount of therapy consists of 40 - minutes sessions daily for 2-3 months. However it is not mentioned whether there is any improvement in the auditory discrimination abilities or other auditory processing abilities with this program (Willeford and Burleigh, 1985).

2. Auditory Perception Training (APT)

Willette, Jackson and Peckins (1970) designed this remediation plan which is used to train essential auditory processing skills based on progressive levels of attainment. Auditory discrimination is one of the five basic units that are trained. These five basic units are presented at three levels of difficulty. This program is designed for children in primary and intermediate grade levels (cited in Willeford and Burleigh, 1985).

3. Auditory perceptual Training program:

Besides being useful to train auditory awareness and auditory vigilance, this program is also useful to train auditory discrimination. This remediation program includes 39 tape-recorded lessons. Exercises for speech sound

discrimination are also included in this. According to Butler, Hedrick and Manning (1973), after training with this program, the child will be able to process auditory information more efficiently.

According to Willeford and Burleigh (1985), even though the authors report that the program was extensively researched and field-tested on over 1500 children, no documentation is provided to support the contention that improvement, if any, is the result of the program rather than of maturation or of other factors.

4. Visco developmental Training program:

This program aims at developing auditory perception using non-verbal auditory stimuli. Sound discrimination and discriminating sound sequences are two of the levels besides auditoiy awareness, localisation and attention that have been identified by the author for training (Etten and Watson, 1977). The three types of responses which are elicited are listening, telling and sensorimotor.

5. *Simon:*

This is a useful commercial game described by Musiek, Baran and Schochat, (1999). This game taps the temporal abilities. It requires the sequencing of tones that generate patterns of sounds and associated flashing coloured lights. A tone is added to the sequence every time the previous sequence is recognized correctly. This game is useful for frequency discrimination training.

6. Fast For Word®:

Fast ForWord® produced by Scientific Learning Corporation, (1999) consists of computer games that incorporate acoustically modified speech in

exercises to improve language decoding skills of children with language learning impairments through helping them to discriminate subtle sound differences.

The game named "Old Mac-Donald's Flying Farm" teaches the children to distinguish phonemic sound changes. In this game the child clicks the mouse as nonsense syllables are produced by farm animals and releases the mouse button only when a different syllable is detected.

A study by Tallal and Merzenich, (1997, cited in Veale, 1999) showed that children were able to discriminate and understand spoken words after trained with this program.

7) Earobics:

This program has been described by Musiek,Baran and Schochat (1999). It emphasizes on auditory discrimination of sounds (mostly speech segments and phonemes) in a variety of frameworks. This program is presently available for 4-7 year olds (Musiek, Baran and Schochat, 1999).

The games Karloon's Balloon, C.C. Coal Car, Caterpillar connection, Basket full of eggs work on auditory discrimination.

8) Speech -in -noise Training :

This program has been developed to improve the auditory discrimination abilities of an individual under conditions of noise. Katz and Burge (1971, cited in Willeford and Burleigh, 1985) analysed the improvement in speech-in-white-noise performance after eight 30 minutes therapy sessions with a group of children from 5 to 14 years of age. They noted post therapy improvement in selecting pictorial representations of monosyllabic words presented in the presence of noise.

Swoboda, Morse and Leavitt (1976) and Cole (1977, cited in Willeford and Burleigh, 1985) have all suggested that the ability to discriminate speech sounds is an innate talent. Rees (1973) hypothesized that if the ability to discriminate speech is innate, perhaps it cannot be improved with therapy. If this is true it would be applicable to speech discrimination in noise also.

VI) Auditory Memory

There are two types of auditory memory for which therapy programs are available. They are:

i) Short term memory

ii) Auditory memory span

Short term memory is the memory for immediate recall. In individuals with short term memory deficits memory for immediate recall is abnormally short. The sound becomes so lacking in meaning that the child tunes it out altogether in time.

Auditory memory span is the ability to remember for increasing length of time. The individuals with these deficit will have difficulty when requested to repeat a series of words or digits.

There are various strategies or techniques that aims at improving the auditory memory. They are:

/. Auditory Perception Training: (Willette, Jackson and Peckins, 1970).

In this training programme auditory memory is one of the five basic units of study that are presented at three levels of difficulty. The remediation plan is used to train essential auditory processing skills based on progressive levels of

attainment. This program is for children in primary and intermediate grade levels (cited in Willeford and Burleigh, 1985)

The disadvantage of this program is the treatment outcomes have not been documented.

2. Auditory perceptual Training Program:- (Butler, Hedrick and Manning, 1973)

This program includes tape-recorded lessons to work on auditory memory which is targeted in the section 'Listen to remember'. In this activity the individual has to recognise the number of sounds and syllables in words and phrases. The authors state that the auditory information processing improves after training with this program, (cited in Willford and Burleigh, 1985).

3. Semel Auditory Processing program: (Semel, 1976)

Auditory memory is one of the areas that is worked upon besides auditory awareness, localisation and auditory attention in this program. The child is shown how to recognise, focus on, discriminate, memorize and categorize the various patterns which are essential to the total auditory process (Semel, 1976 cited in Willeford and Burleigh, 1985).

The main principle of this program is treating CAPD by working primarily on speech-sound identification. Since the individuals with CAPD have poor verbal comprehension under unfavourable listening conditions it is not clear whether this program would help such individuals.

4. The fourth 'R' Remembering:

This is a program prepared by Hays and Pereira for parents and teachers. This program has been described by Etten and Watson (1977). The activities are

presented in the form of games. They are designed to develop memory and attending abilities of young children.

The book is divided into eight chapters. The first includes memory techniques. The lessons are organized according to the Guilford's Structure of the intellect. The sequence of the lessons are (1) Teacher and children discuss and handle lesson materials. (2) Memory technique for particular game is discussed and practiced. (3) The game is demonstrated (4) The game is played (5) The game is repeated.

A work book of exercises and supplementary aids accompany the text. According to the authors, it is a well organized program, which is informative without being technical. However, the efficacy of this program has not been mentioned by the authors.

5. *Mnemonic Techniques:*

Mnemonics refer to artificial or contrived memory aids for organizing information (eg. Acronyms, rhymes, verbal mediators, visual imagery, drawing) that operate through the application of basic learning principles. (Examples of basic learning skills are association, organization, meaningfulness, attention). (Harris, 1992; Loftus and Loftus, 1976, cited in Chermak and Musiek, 1997).

In contrast to naturally learned strategies, mnemonics are consciously learned and used. Mnemonic techniques and systems have shown to improve memory in subjects of various ages, including preschool age children and older adults (Lenin, 1976, Treat, Poon, Fozard and Popkin, 1977, cited in Chermak and Musiek, 1997).

According to Musiek and Chermak, (1995) elaboration, transformation, chunking and coding are the four mnemonic techniques encompassing the majority of frequently used internal memory devices.

i) Elaboration:

Involves assigning meaning to items to be remembered by recasting them in meaningful sentences, analogies or acronyms. First Letter cueing to form acronym aids memory for sequences. Verbal chaining or grouping items into sentences may facilitate memory for otherwise unrelated items. The use of rhymes, paraphrases and summary are examples of elaborative techniques.

ii) Transformation;

This involves recasting complicated material into a more basic form that can be remembered more easily. This gives the individual a concise means for storing complicated material,

Eg. Converting theories into equations $E = MC^2$

Some types of paraphrasing may also be considered transformations and thus benefit memory.

iii) Chunking:

Involves organizing items into categories.

Eg: Organizing a mental shopping list into produce, dairy, meats and condiments.

iv) Coding

Recasting the form in which the information is presented. Creating mental images or drawing pictures to capture information presented auditory are

examples of coding. Mental images may involve real sense, absurd mental pictures, or improved mental charts and diagrams. Drawing may be a particularly useful coding techniques for individuals experiencing spoken language processing difficulties, because drawing activates the primary motor cortex of the right hemisphere and thereby applies bio-hemispheric processing to a verbal memory task.

V) Practice

Practice or rehearsal is a necessary and common method employed to improve memory; however the quantity of practice is secondary to the quality of practice. (Bauer and Emhert, 1984; Swanson, 1983; Wong, 1982, cited in Chenmak and Musiek, 1997).

6. Fast ForWord®

Auditory memory is one of the skills that is targeted for remediation through this computer based program besides various auditory skills such as auditory attention, discrimination etc. The game 'Phonic Match' reinforces memory and reasoning skills within nonsense syllables that differ by a single phoneme.

Tallal et al. (1996, cited in Veale, 1999) has reported that children improved formal tests of memory significantly on formal testes of memory for commands and grammatical comprehension after training with this program.

According to Gillam (1999), Fast ForWord® influences memory in addition to attention, general listening skills and executive functions.

7. *Simon*

This commercial game described by Musiek, Baran and Schochat (1999) is helpful for auditory memory besides being helpful for temporal ordering and frequency discrimination training. This game requires the sequencing of tones that generate patterns of sounds and associated flashing coloured lights. A tone is added to the sequence every time the previous sequence is recognized correctly.

VII) Auditory Sequencing Ability:

Auditory sequencing ability is the ability to identify a series of sounds in correct and respective order. Any deficit in this ability will be manifested in terms of difficulty in re-picturing or rebuilding in order of presentation, sequences of letters, of sounds or of units of movements. (Chermak and Musiek, 1997).

The different programs, which involve activities to improve auditory sequencing abilities have been given below.

1. *Auditory Perceptual Training Program: (Butler, Hedrick and Manning, 1973)*

The remediation program consists of tape-recorded exercises for various auditory processing skills including temporal sequencing. These are taught through exercises such as, listen for sounds, listen for words and speakers' etc.

The authors report that this training program enhances the auditory processing abilities (Willeford and Burleigh, 1985).

2. Phonemic Synthesis Training :- (PS Training)

Katz and Burge (1971, cited in Willeford and Burleigh, 1985) studied phonemic synthesis which is the ability to blend individual phonemes in correct sequence to form a word. This therapy program uses prerecorded tapes from which the child is requested to blend two and three phoneme words.

According to Katz and Harmon (1981, cited in Willeford and Burleigh, 1985) the reason PS training might be effective may be because the child learns that words are made up of discernable units which can be manipulated and the child uses his ability to decode new words.

3. Rattler's Program:

Auditory sequencing is one of the three areas i.e trained using this programme. Class activities and games are given in this program. The sound sequencing activities are designed to emphasise motor sequencing, following directions in sequence and vocabulary of locations (Kottler, 1972, cited in Barr, 1976).

4. Fast ForWord®

This program aims at remediating temporal processing deficit besides other auditory processing skills. According to Tallal, (1990,cited in Veale,1999) temporal processing deficit refers to difficulty in recognizing and sequencing

rapidly presented auditory and visual information.

A study by Merzenich et al. (1996, cited in Veale, 1999) has shown that temporal processing abilities improved in children who received training with Fast ForWord® when compared to children who received equivalent training with natural speech materials.

VIII) Fracturing ability:

It refers to the ability to identify each discrete sounds in a word. If this ability is affected then the individual will not be able to identify the sounds in a word. Various programs include activities to improve this fracturing ability.

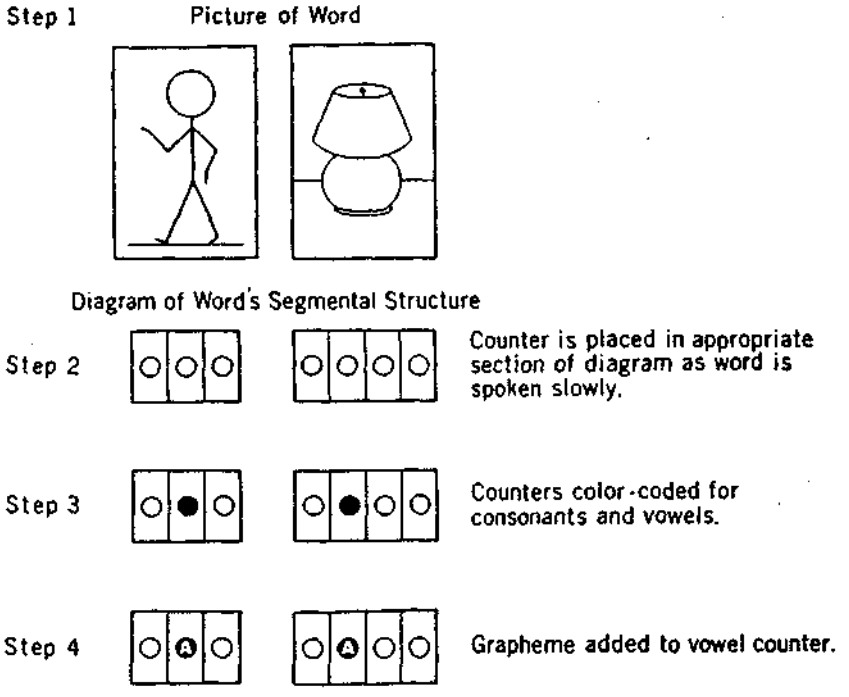
/. Elkonin Procedure:

This program was given by the Soviet psychologist, Elkonin in 1973, cited in Liberman, Shank weiler, Camp, Blachman, Werfelman (1980). In this procedure, the child is presented with a line drawing of an object which reliably elicits a word in the child's active vocabulary. Below the picture is a rectangle divided into sections equivalent to the number of phonemes in the pictured word. The child is taught to say the word slowly putting a counter into the appropriate section of the diagram for each phoneme as the word is pronounced. After this game has been played with many different pictured words, and when the child can do the task successfully without the diagram, the idea of vowel and consonant sounds is introduced. The colours of the counter is different for vowels and consonants (e.g. pink for vowels and white for consonants). When only one vowel is present the child is asked to put it in the pink counter.

The Elkonin procedure has many advantages. The line drawing enables the child to perceive the whole word which is placed in front of the child, through out the process of analysis. This eliminates the need to rely on auditory memory to retain the word being studied. The sections of the diagram call attention to the actual number of segments in the word, thus the child does not need to resort to guessing.

The actual content of the Elkonin procedure can be varied to fit the needs of a particular child or group of children.

According to Liberman et al., 1980 two segment analysis is easier than three segment and a progression from VC to CV in segmentation training would be more effective.



2. Semel Auditory Processing program (SAPP), (Semel, 1976):

In this program the fracturing ability of an individual is worked upon by teaching the child to categorize, integrate and synthesize. The primary emphasis of SAPP involves identification of target sounds in various words.

According to Etten and Watson, (1977) there is no evidence that this program obtains the desired results with children with CAPD.

3. Slingerland's Method:

This is a more traditional method given by Slingerland in (1971, cited in Liberman et al. 1980). In this method the child is not asked to blend the phonemes into words, but the teacher first says the word, slowly emphasizing on

the medial vowel. The child repeats the word, listens for the vowel sound, selects its letter card (colour coded if necessary to differentiate vowels from consonants) from a wall-pocket chart and places it in a lower tier of the pocket chart. The teacher then repeats the whole word and asks the child for the initial sound in the word. The child is then directed to pick out the appropriate letter card and place it in front of the vowel. The teacher then draws the finger along the two letters that the child has placed in the lower tier and makes the child listen to the sound again and encourages the child to find the letter that makes the last sound. The lesson continues with the child reading aloud the whole word that has just been constructed and ends with the child writing the word either on the black board or at the desk and reading it back after it is written.

Eg:

Ham

a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**1**	**m**
n	**0**	**p**	**q**	**r**	**s**	**t**	**u**	**v**	**w**	**x**	**y**	**z**

----------a----------

——————ha——————

——————ham——————

IX) Binaural Separation:-

It is the ability to process an auditory message coming to one ear while ignoring a different message presented to the other ear at the same time. An individual with binaural separation deficit will have difficulty in listening to others while a person next to him is talking to him.

Binaural separation is critical in everyday listening, particularly in a school environment. Situations arise frequently in which a listener is required to ignore linguistic information from one source while focussing his or her attention to a primary message. The behavioural symptom of binaural separation deficit can be difficulty hearing in background noise when more than one person is talking at the same time.

1. Auditory Perceptual Training Programme (Butler, Hedrick and Manning, 1973)

This program is aimed at remediating different auditory processing skills including binaural separation. There are different tape recorded lessons, which have exercises for binaural separation. These exercises include 'Listen to remember' which is figure-ground discrimination through competing messages. The next exercise is 'Listen to learn', which utilizes more difficult competing messages.

2. Heasley 's Method, (Heasley, 1980)

Figure-ground or competing sound stimuli often represent serious learning blocks to the auditory disabled individual The listeners attention is easily distracted from the signal in the presence of extraneous, irrelevant sounds.

According to Heasley (1980) the development of auditory attention and attention span will help the listener to attend to the desired message while ignoring other sounds.

In this method, initially a child has to listen and repeat words and sentences that are presented in the presence of soft background sound from a record player or radio. Then questions will be asked in the presence of gradually louder extraneous sound. The next step is to tell a story against background

sound that can be controlled for loudness and questions should be asked about the story. Appropriate reinforcements should be given for the correct response.

3. *Bellis' Method (Bellis, 1996)*

She has suggested approaches for the management of binaural separation dysfunction. It includes environmental adaptations that improve the listener's access to target auditory information while decreasing competing signals and also the teaching of compensatory strategies to assist the listener in directing attention.

X) Binaural integration

Binaural integration is the ability to process information presented to both ears simultaneously, when the information presented to both ears are different. Binaural integration comes into play in every day listening situations. An examples of listening situation in which the process of binaural integration would be relied upon might be that of a mother who is attempting to carry on a phone conversation while simultaneously listening to the demands of her child. In this situation the mother must be able to process information from both sources, thus utilizing the process of binaural integration.

An individual with deficit in binaural integration will not be able to integrate or process information from more than one source at a time.

/. Bellis'Method (Bellis, 1996)

She has suggested approaches for the management of binaural integration dysfunction. It includes environmental adaptations that improve the listener's access to target auditory information while decreasing competing signals and

also the teaching of compensatory strategies to assist the listener in directing attention.

XI) Reauditorization

It refers to the unvoiced recollection and holding of a sound production either at gross sound level or speech level. There are different programs that work on this auditory imagery. Reauditorization is the process by which the production of a sound is remembered and the production in practiced mentally before it is said aloud.

1. Auditory Perception Training: (Willette, Jackson and Peckins, 1970)

This remediation plan is used to train the different auditory processing skills including auditory imagery. They are presented at there levels of difficulty. This program is designed for children in primary and intermediate grade levels (cited in Willeford and Burleigh, 1985).

XII) Acoustic contour Recognition:

It refers to the ability to recognize acoustic contours i.e the ability to extract and utilize prosodic aspects of speech such as rhythm, stress and intonation.

Individual whose acoustic contour recognition ability is affected will have difficulty in recognizing and using prosodic aspects of speech and difficulty in extracting key words from a spoken message. They will be unable to discriminate subtle differences in meaning brought about by changes in relative stress and intonation. These individuals usually have inadequate variations in intonation.

Prosody training is usually carried out to work on the acoustic contour recognition. Strategies such as reading aloud with emphasis on intonation, stress and rhythm are also followed.

Two programs that work on acoustic contour recognition are described in the following section.

/. Auditory Perceptual training Program: (Butler, Hedrick and Manning, 197).

This remediation plan includes tape-recorded lessons to teach identification of intonation patterns, besides working on other auditory processing skills. This program is applicable primarily for students in grades one to three or learning disabled students through grade six. According to the authors auditory information processing is effective after training with this program, cited in Wileford and Burleigh, 1985).

2. Prosody Training:

According to Musiek and Chermak (1997) prosodic training should begin with words in which a change in the syllabic stress pattern changes the meaning of the word. Once the child is trained with words, then the focus should be on sentences in which subtle differences in stress, temporal cueing or other prosodic features alter the meaning of the entire sentence.

The children also should be trained to detect the key words. The child may be taught to listen specifically for subject, verb and object while placing less emphasis on article, conjunctions and other less important words.

Reading aloud daily with special emphasis on animation is a good exercise for these children. It not only increases the reading aptitude but also reinforces the use of rhythm, stress and intonation in expressive language (Bellis,

1996). According to the authors the children will be able to process auditory information more efficiently after training with this program.

From the review of literature it is evident that there are several programmes each having a number of activities aiming at improving the auditory perceptual skills of children having auditory processing problems. While some are commercially available, others are not. The activities target at improving specific auditory deficits that may be present in a child. The choice of an activity or activities would depend on the auditory perceptual problems faced by the child.

HANDOUT FOR AUDITORY MANAGEMENT OF AUDITORY PROCESSING DISORDER

Auditory processing is the process through which the information that is received through the external ear is analyzed, synthesized and interpreted. Efficient auditory processing requires an intact functional binaural peripheral auditory mechanism and central nervous system pathway.

A Central Auditory Processing Disorder (CAPD) has been defined as the in ability or impaired ability to attend, discriminate, remember, recognize or comprehend information presented auditorily, eventhough the person has normal intelligence and hearing sensitivity.

Auditory processing dysfunction in the presence of normal hearing is associated with difficulties in the areas of communications, language acquisition and development, reading and learning.

I Symptoms:

Some of the more common difficulties or the common symptoms that are associated with auditory processing dysfunction are given below:

The children with CAPD can have deficits

i) In communication

a) Expression

- Reduced quantity of verbalization
- Inadequate vocabulary
- Defective sentence structure
- Dependence on gestures to express information.

- Inability to verbalize experiences using series of words,

b) Reception

- Disregard of speech or all sounds
- Poor auditory discrimination
- Better responses in quiet than in noise
- Poor retention or failure to remember what was heard
- Hypersensitivity to noise
- Difficulty following verbal directions.

2. *In learning*

- Inadequate reading and or spelling
- Poor comprehension of what is read
- Disorganization in the content of written material
- Poor mathematical abilities
- Inability to perceive prosody resulting in spoken sentences sounding like strings of unrelated words, which in turn leads to impaired comprehension of spoken messages
- Discrepancy between verbal and nonverbal scores
- Discrepancy between achievement level and potential for learning
- Difficulty in executing multimodality tasks such as taking dictation, drawing a picture from verbal or written instructions.
- Inability to apply rules of language to incoming acoustic information such as difficulty with sentences presented in the passive voice.

- Apparent academic difficulties when the linguistic demands within the classroom increases.
- Deficit in the ability to sequence plan and organize responses.
- Impaired motor planning resulting in poor fine and gross motor skills.

3. *In social - Emotional Behaviour*

- Frustration, isolation and impaired interpersonal relationships.
- Limited attention span
- Impulsiveness and inappropriate emotional reactions.
- Immature self-help skills.

All these deficits may not be seen in the same individual. There is no single overall profile of performance that can characterize the individual with an auditory processing disorder. An auditory processing disorder can exist in an individual who has no other apparent problems or it can be a part of complex problems relating to speech and language development.

The best means of evaluation and diagnosis of a child with CAPD is to assess the child with a variety of tests that focus on different aspects of audition and central auditory tests that are employed to assess the functional proficiency of the Central Auditory Nervous System (CANS).

II Assessment:

The assessment can be done in different ways. It can be either

- Formal assessment
- Informal assessment

III Management:

The assessment will continue even during remediation in order to chart progress, establish new goals and make necessary changes in procedure.

Aim of Auditory processing remediation

The primary objective of auditory processing remediation is to improve the communication by maximizing the contribution of the auditory system, improvement of linguistic and academic skills that depend on accurate auditory processing for their development and maintenance, improvement of psychosocial adjustment through the better reception and interpretation of warning sounds and ambient environmental sounds.

There are different management procedures and techniques that aim at improving the deficit seen in specific auditory processing skills. The techniques are as follows.

Management procedures

The different management procedures used with CAPD are

1. Auditory training techniques.
2. Signal Enhancement procedures
3. Linguistic and metacognitive interventions.

The major focus on this hand out is on the auditory training techniques.

Auditory Training Techniques:

The use of auditory training (AT) for CAPD is based on the belief that AT would assist these individuals by maximizing the use of their hearing abilities. The foundation of modern AT is brain plasticity. Recent researches have also provided evidence that AT can enhance various auditory processes by a reorganisation of auditory neural substrate.

Various authors have opined that the intensive training that follows behavioral principles which increase the temporal processing requirements of a task should result in maximum reorganisation of the neural mechanisms that support temporal processing. Further, this neural reorganization should resolve the temporal processing deficits that underlie language learning impairments and should lead to improved language learning.

To get the best results with auditory training, the individual should be motivated since a highly motivated client has a far better chance of improving than an individual who has little interest in AT as a means to their overcoming such problems. Auditory training programs must match the age of the child.

Selection of the specific type of auditory training depends on what auditory processes are not working appropriately. It is evident that none of the auditory processes work independently. Hence the auditoiy training may involve more than one auditory processes.

In the following section remediation activities for each auditory perceptual deficit has been given.

I) AUDITORY AWARENESS:

Awareness is defined as the ability to recognize and respond to the presence or absence of sound.

Initially the remediation exercises should begin with sufficiently loud and long signals to assure awareness. Both loudness and duration may be reduced as the listener gains skill as indicated by appropriate consistent responses.

Exercise : 1.1

Name : **Hear and Respond**

Materials : Record Player / Tape Recorder / TV / Radio

(Individual activity).

Procedure :

Most of the children will require only brief practice on this exercise.

Step : **I**

Seat the individual very close to a record player, tape recorder, television or radio. Turn the volume up loudly enough that he can recognize when it is turned on or off. Place his hand on the instrument so he can get additional help from the channel of vibration. Turn it off and on several times until the listener consistently indicates awareness of the presence or absence of sound by **a** designated method of response.

Step : **II**

In this step the above exercise is repeated but the individual is requested to either raise his finger or nod his head or say yes when he hears the -sound. It is permissible for him to watch this step.

Step : III

In this step the listener's vision is obscured and the exercise is repeated. A written record of the number of trials and successful responses can be maintained which will help in evaluating progress.

II) AUDITORY LOCALIZATION

Auditory Localisation is the ability to identify the direction from which a sound or series of sounds originated.

The following programs or techniques or exercises will be used if the individual is unable to localise the sound.

Exercise: 2.1

Name : Direction Hunt

Materials needed : Sound instruments

(Group activity)

Procedure :

Station two or three children in various locations in the room. Each should have identical sound instruments. One should make a noise with the instrument. The listener's vision should be obscured. The listener should indicate from which direction the sound came.

Gradually decrease the volume and repeat the above exercises. Repeat the exercise introducing a short time lapse between the signal and the response from the child. Steadily increase the time lapse to develop memory for localisation of sound.

Progressively move to a greater distance. This signal should be presented comfortably louder. This will assist the listener to project listening for localized sound.

Exercise: 2. 2

Name : Find the sound

Materials needed : None

(Group activity)

Procedure :

In this activity, each child is given an animal name and one child is made to stand in the centre with his eyes blindfolded. The other children are made to stand in separate corners of the room. They take turns and make the animal sound. The teacher asks the child standing in the centre to find where a particular animal is. The child should listen from which direction the animal sound is coming and he should go to the child with that animal name.

If the child correctly detects the sound, the child who is standing in that place has to go to the centre, and the teacher assigns new animal names and the game continues.

III) AUDITORY VIGILANCE

The ability to sustain attention is otherwise known as auditory vigilance. The level of perceptual organisation involves in the first instance, a prerequisite set which is called as attention readiness. This function distinguishes hearing from listening. Auditory attention is an aspect of auditory perception that improves as a result of programmed listening exercises combined with behaviour modification techniques.

Exercise: 3.1

Name : Stop ! It's wrong

Materials : Picture cards

(Individual activity)

Procedure :

This activity aims at improving the child's listening attention for specific details with the use of short stories or narratives that has been modified to include absurdities or false statements. When the child hears something wrong in the story, he should immediately say, "Stop ! It's wrong'. He should then explain what was wrong and what should have been read.

Eg:

Show the picture of an antique car and read the passage.

The child's response should be:

When modem (Stop ! It's wrong) cars are built, they always have wooden wheels (Stop). The dog sits (Stop) in the back seat. The car has seven wheels (Stop). There are no head lights (Stop).

Exercise : 3.2

Name : They can fly

Materials : None

(Individual Activity)

Procedure :

This is an interesting activity to improve auditory, attention. In this game the therapist names different things that can fly such as ducks, birds and airplanes. As the therapist calls out "Ducks fly, Birds fly, Aeroplanes fly", he or

she moves the arms as if Hying. The child follows as long as the therapist names something that can fly. If the therapist says "Elephants fly' and although the therapist continues to keep the arms moving as in flying, the child must stop moving his own arms. If desired, a point system can be devised for scoring.

Exercise: 3.3

Name : **Blind man's Buff**

Materials : Trash can /Books /Ball /Tin /Chair

(Group activity)

Procedure :

This is an activity to improve auditory attention. This activity may be played indoors or outside. Mark off an area about four feet wide and ten feet long. Within this area form an obstacle course by placing objects such as trash can, books, a ball, eraser, crumpled paper etc. The child will be blind folded **and** will be made to walk through the obstacle course by listening to directions. The person giving directions tries to guide the player around or over the objects with directions like, 'Lift your right leg high and step Forward about two feet or more to the left and go Forward '. This activity will be fun for the observers as well as for the participants.

Exercise 3.4

Name : **Red light** / Grreen Light

Materials : None

(Group activity)

Procedure :

In this activity the child stands at one end of the activity area and the therapist stands in the middle of the activity area. When the therapist calls out

'Green light' the child should start running to the other end of the playing area. Whenever the therapist calls out 'Red light' and the child should stop and remain standing in his/her place. If the child is caught moving, he/she must go back to the starting line.

Exercise : 3.5

Name : Clap & Move

Materials : None

(Group Activity)

Procedure:

The therapist claps his or her hands using slow beats or fast beats. The child moves around the area in rhythm to the sound of the hand claps. The child walks on the slow beat and runs on the fast beat. The child must be alert to respond to the different beats. After a while the therapist and child can exchange places.

Exercise: 3.6

Name : Ball chase

Materials :Ball

(Group activity)

Procedure:

This is yet another activity for auditory attention. It requires four or more players. They are divided into two or more groups. Each groups is given the name of a flower such as rose, lily, jasmine etc. The small groups then mingle into one large group. The therapist throws a ball away from the group, at the same time calling out one of the flower name.

All of the players from the group having this flower name, run after the ball. The one who gets possession of the ball first becomes the leader for the next round of the game, or may be given a reward point.

Exercise : 3.7

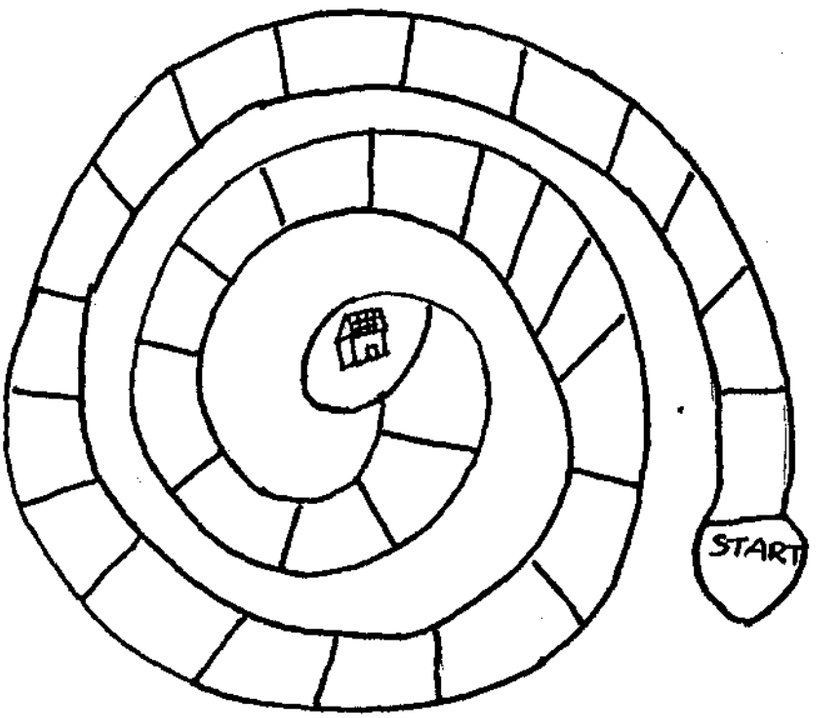
Name : Listen & Move

Materials : Sheets, Marker

(Group activity)

Procedure:

This is a game for auditory attention and rhythm. Children are given sheets marked with a large circle in which a path of squares has been drawn. Each child is given a marker of some sort. The therapist claps two or three times and children move their markers through the squares according to the number of claps they hear. Children who finish too soon or two slowly need further practice to improve these skills.



Exercise 3.8

Name : Listeneers

Materials : Work sheets, crayons

(Individual activity)

Procedure :

This program consists of simple rhymes which when used as suggested, improves the auditory processing skills such as attention. The therapist tells the child that he/she is going to read a short poem to the child and the child has to listen carefully and do something about what he/she has heard.

The activity is as follows:

The poem is read to the child. The therapist then folds down the top of the worksheet so that only the picture or blank portion of the sheet is available. The child then draws or finishes a picture based upon what was heard. If errors are there, the poem is reread and the child is helped to recognize the errors.

Listeneer can be scored and a percentage of adequacy can be calculated from this. The activities are graduated in difficulty. If the child fails to score at the seventy-five percent or greater level of success, the therapist should repeat that activity the subsequent week.

Example -1

1. Miss Millicent mouse

   Poor Miss Millicent Mouse

   Had lost one red shoe

   So she ate some blue cheese.

   While she thought what to do

Finish the picture of Miss Millicent Mouse

Score :

Red Shoe :———————

Blue cheese :———————

% correct : . . . . . .

Example 2

Ronald Rooster

Ronald Rooster stood on **a** rock

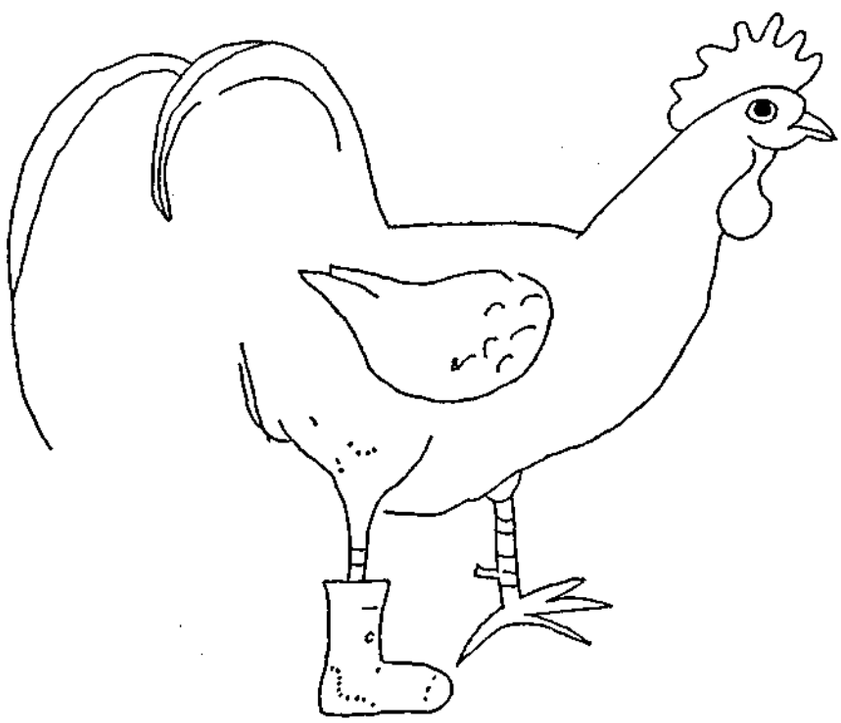
He had **a** droopy red tail.

And a bright purple sock.

When he crowed in the morning

He said'tick tock'

Picture



Score:

Rock :_____

Red tail :_____

Purple sock :_____

% correct :.....

Exercise 3.9

Name : Find the secret word

Materials : None

(Group activity)

Procedure :

In this game, at the beginning of the class, the teacher should announce that he /she has a secret word related to a particular concept eg. food, which he/she would use only once every 10 minutes. The children have to listen carefully and try to guess the word. When the students think they have got the word they should share it with the teacher secretly.

If no one gets the word, the teacher should say what was the word at the end of the day. The first student to discover the secret word can be rewarded.

Exercise 3.10

Name : Fire on the mountain

Materials : None

(Group activity)

Procedure:

This is an interesting group activity which helps in auditory attention. In this game the children have to form a circle. The leader stands in the cente and he has to say fire on the mountain, run, run, run," and the children start running. The leader repeats the above sentence and then he suddenly stops and gives a command or says a number. If the leader says the number three, the children should group themselves in threes or if the leader says jump, the children should

jump and so on. If he /she does not do the activity correctly he/she will be cut of the game.

Exercise 3.11

Name : Simon says

Materials : None

(Group activity)

Procedure:

Playing ' Simon says" is a pleasant way to teach students the importance of listening carefully. All the students should be standing and the leader gives the students a series of commands: Stand up; Hop three times; clap your hands and so on. If the leader inserts Simon says' before the command the children have to obey. If the leader does not say 'Simon says' they must not follow the directions. If they follow the instruction at such times are out of the game and the activity continues.

Let each be the leader for five minutes to see how many persons he or she can get out of the game.

Apart from the above activities the activities for auditory memory and exercises 5.1 to 5.can also be used for auditory attention.

IV) AUDITORY CLOSURE

Auditory closure is defined as the ability to utilize extrinsic and intensic redundancy to fill in missing portions of auditory signals to recognize a whole message.

Exercise 4.1

Name : Find the missing word

Materials : List of words

(Individual activity)

Procedure:

This activity involves the therapist reading aloud a sequence of sounds or words. Then the sequence of words is repeated again but one word will be committed. The child's task is to identify the omitted sound. As the skill is gained, the number of words presented, as well as the number of omitted words should be increased.

If the child is able to do the above task correctly, sentences can be used. The therapist reads a sentence and then repeats once again omitting any one word. The child has to identify the omitted word. As the child gains this skill, the sentence length and the number of omitted words should be increased.

Exercise 4.2

Name : Associated words

Materials : None

(Individual activity)

Procedure :

The therapist says a sentence and the child has to provide as many appropriate words as possible. Scores are given for the correct words.

Eg:

Stimulus sentence: Don't touch it! It will hurt.

Possible words: Hot shore, fire, razor, blades, knife, thorns, pins, electric fence.

Exercise: 4.3

Name : Who am I

Materials : Picture cards

(Individual activity)

Procedure :

In this game the teacher reads the description about an object or an item. The child has to guess what that item is. For younger children it will be desirable if a choice of three or four picture are presented as additional clues.

Eg: I am a vegetable

I grow on a tree.

I am long and green

Part of my name is that of a musical instrument.

Who am I?

Response

The response should be, the child should guess in a complete sentence.

"Are you a drumstick" ?

Exercise 4.4

Name : What goes together

Materials : None

(Individual activity)

Procedure :

This is an interesting activity for young children. The therapist says a word and the child has to say what goes together with it.

Eg: Bread and Butter

Salt and pepper

Pepper and pencil

Exercise : 4.5

Name : **Part of What ?**

Materials : Picture cards.

(Individual activity)

Procedure :

This activity is similar to the previous one. In this the therapist says **a** word and the child has to say as to what it is a part of.

Eg:-

Pages (Note book)

Nib (pen)

Wheel (car / bus)

Exercise: 4.6

Name : Sentence **completion**

Materials : None

(Individual activity)

Procedure :

This game involves the therapist reading sentences that are constructed around various situations. The child's task is to complete the given sentence. The sentence should be simplified for younger children and complex for order children.

Eg :-

The meal after breakfast is called lunch

When it gets dark, we turn on the rights

Exercise: 4.7

Name : Rhyme Time.

Materials : None

(Individual activity)

Procedure

This is a game in which the therapist reads a sentence and the child has to finish the sentence with a rhyming word. The sentences should be selected depending on the age of the child.

Eg: 1. George and Paul

Chased the ball

2. The old grey cat

Chased a rat

Exercise 4.8

Name : Guess me!

Material : None

(Individual activity)

Procedure :

The therapist says a list of words which are related to a vocation or an activity and the child's task is to identify, what vocation these words are indicating. For younger children simple words which are familiar to them should be presented.

Eg: Thread, seam, thimble, scissors, pattern, pin, needle.

Ans: Sewing

Exercise : 4.9

Name : **Opposite**

Material : Picture cards

(Individual activity)

Procedure :

The therapist says a word. The child should listen carefully and select the picture of the opposite word or give its name verbally or write the opposite word. Initially for younger children common opposites should be used and when the children are able to do this task correctly more difficult words can be presented.

Eg: Out (in)
Wet (d r y) } Easy
Up (down)

Include (omit)
Construct (destroy) } Difficult

Exercise: 4.10

Name : **Fill** in **the blanks**

Material : None

(Individual activity)

Procedure :

This exercise involves making syntactical closure. The therapist - reads a sentence with a blank in between. The child has to fill in the blank with syntactically appropriate word.

Eg: 1. Dad saw a tiger. I saw two tigers.

2. This puppy is brown, these puppies arebrown.

Exercise: 4.11

Name : Unscramble

Material : None

(Individual Activity)

Procedure :

In this activity the therapist reads a sentence and the listener has to unscramble on or more words to make a meaningful sentence.

Eg: 1. She left her booth trush on the sink.

Ans: She left her tooth brush on the sink.

Exercise: 4.12

Name : Correct the incorrect

Material : None

(Individual activity)

Procedure :

This activity involves grammatical closure. The therapist reads aloud the incorrect sentence and the child has to correct it. For younger listeners it may be necessary for the therapist to provide both incorrect and correct sentences and assist through discussion and explanation, the listener to chose the sentence which sounds best. For older children it is an ideal opportunity to introduce rules of grammar.

Eg: 1. Mother said I done a good job.

Ans: Mother said 1 have done a good job.

2. My brother seen a pheasant this morning

Ans: My brother saw a pheasant this morning.

Exercise: **4.13**

Name : Select a **card**

Material : Word cards

(Individual activity)

Procedure

A list of words on cards is given to the listener. The child is told that a short story will be read to him in which every sixth word is omitted. Then the therapist reads the entire story aloud to the listener, pausing where the omissions occur. Following this the therapist once again reads the story pausing at the every sixth word that is omitted till the child gives the appropriate word card.

Eg: Word cards for listeners

Go	For	To	Spring
Their	Sleep	Like	Nuts

Story:

When the weather begins to get cold squirrels look for nuts to store in their nests for winter. They **like** hickory nuts and beech **nuts.** When winter comes squirrels sleep most of the times. They do not have to go outside their nests until spring

Exercise: 4.14

Name : Guess the missing word

Material : None

(Individual activity)

Procedure

This is one of the activities that work on the auditory closure abilities which help the children quickly learn to depend on structural clues and semantic context. Here a selection from literature is presented aloud in which every fifth word is omitted and the students have to fill in any word that makes sense.

Eg: Autumn arrived and the————began. Since the soldiers———— went barefoot or had————boots, many caught cold————»The whole army was————and sniffling. But it————impossible to postpone the————.

Exercise: 4.15

Name : **Brain Ticklers**

Material : None

(Individual activity)

Procedure :

In this activity the therapist reads a short story to the listeners. Jargon words will be substituted for common words. The children should guess what the jargon word stands for based on the context of the story. The therapist should word them in such a way that sequence of the story will permit interpretation of the jargon word.

Eg: Sally planted some marigold seeds in her garden. Sally said to the seeds, Hurry and PLEEKO|. Ten minutes later, the seeds had not PLEEKOED. A week later, little green leaves were coming out of the ground. You have finally PLEEKOED, Sally cried. That afternoon it ROGGLED. The PLEEKOES got all wet.

PLEEKO : Sprout

ROGGLE : Rain.

Exercise: 4.16

Name : Rebus

Material : Picture cards, objects

(Individual activity)

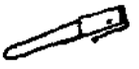
Procedure :

A rebus is a representation of a word or phrase through symbols or pictures. The rebus can be used to work on the auditory closure ability. The therapist says a sentence and he /she will show symbols or pictures for a syllable, word or phrase and the children have to identify what the sentence is.

Eg: If the sentence is

This is a pencil

The therapist says "This is a" , then shows a "pen" and then says cil.

This is a  cil

The child should identify it as "this is a pencil".

Note: Apart from this the exercise given in 7.11 can also be used to work on auditory closure.

V) AUDITORY DISCRIMINATION

This activity requires the client to decide whether the two stimuli are the same or different. Auditory discrimination exercise should be carried out in a systematic way i.e. Initially he should be made to discriminate grossly different environmental sounds, and then sounds that have lesser difference.

Exercise 5.1:

Step 1: (Discriminating grossly different environmental sounds)

Present different environmental sounds such as whistle, glass and spoon, plate and spoon, door knock. Initially the sounds may be made by the children and they should to listen to the sounds and remember them. Later the therapist will make any two sounds and the child should say whether the two sounds are from the same or not.

Step 2 : (Discriminating animal sounds)

Present different animal sounds such as moo, Bow Bow, Ba-a-a, Meow etc. The child has to say whether they are same or different.

Step 3 : (Discriminating vowel sounds)

Present the different vowels and ask the child to imitate them. Then say the vowels and ask the child whether they are same or different.

Step 4 : (Discriminating syllables)

Present different syllables such as bee, bow, bah, buy. Ask the child to imitate them. Present these syllables once again in pairs. Ask the child to say whether they are same or different.

Step 5 : (Discriminating words)

When the child is able to gradually discriminate the syllables , words should be introduced. Initially the words may involve only a single syllable with the same consonant given in the initial position.

Eg: Ball

Bat

Box

When the child is able to discriminate these words, present words with the same consonant in the final position such as tab rub rob robe etc.

Eg: Tab

Rub

Rob

Later words with more syllables which are more similar, should be used.

Exercise 5.2

Name : **Man from Mars**

Materials : None

(Group activity)

Procedure :

This game works on auditory discrimination. One child is selected to be the man from Mars and stands in the centre of the activity area. The others stand behind a line at the other end. The game begins when the children call out "Man from Mars, can we chase him through the stars ?". The therapist answers, 'Yes, if your names begins with the same sound as duck' (or any other word). All the

children whose names begin with the same initial sound as Muck', or whatever word is called, chase the man from Mars, until he is caught. The child who catches him becomes the new man from Mars and the game continues.

Note: For the children to run at the right time they must listen carefully and match the initial speech sounds. If the therapist sees a child not running when he should, individual help can be given.

Exercise : 5.3

Name: Crows and Cranes

Materials : None

(Group activity)

Procedure :

This is an interesting game to improve the auditory discrimination of consonant blends. This activity requires several player. The playing area is divided by a center line. The players are divided into two teams. There should be a minimum of three or four in each team. The players in one team are designated as crows and take a position on one side of the playing area. The members of the other team are designated as cranes and take a position on the other side of the playing area. The far baseline of each team is the safety zone. At the start the crows and cranes are about 3 feet apart. The therapist calls out Cr-r-anes or Cr-r-ows. The initial consonant blend 'cr' is emphasized. If the therapist call 'crows' they turn and run towards their baseline to avoid being caught. The cranes try to catch their opponents before they cross their baseline. The cranes score a point for each crow caught, They return to their places and the therapist proceeds to call one of the groups and the play continues in the

same manner. The game can be extended to include other words beginning with consonant blends for

Eg: Swans and Swallows, Storks and Storklings, Squids and Squabs.

Note : Repetition of the consonant blends during the game helps children to become aware of these sounds and to develop their auditory perception of the blends in the context of words.

Exercise : 5.4

Name: Count me

Materials : None

(Individual activity)

Procedure :

In this activity any story or interesting passage should be recorded and played to the children. The children's task is to identify the number of times a particular sound occurs in that passage. Initially the passages that have sounds that are grossly different should be taken and then passages with similar sounds should be taken.

Eg: Identify the number of times 'b' occurs in this passage.

Note: Apart from this, the exercises given in 8.3, 7.7, 7.10, 3.10 can also be used to work on auditory discrimination.

VI) AUDITORY MEMORY:

There are two types of auditory memory deficits that may be evident in children with auditory processing problems. They are ;

(i) Short term auditory memory

; (ii) Auditory memory span

Short term auditory memory is the memory for immediate recall. In individuals with short term memory deficits, memory for immediate recall is abnormally short. The sound becomes so lacking in meaning that he tunes it out altogether in time.

The individuals with auditory memory deficits will have difficulty when requested to repeat a series of words or digits.

Auditory memory can be worked on by using mnemonics which refer to artificial or contrived memory aids for organising information that operate through the application of basic learning principles such as association, organisation, meaningfumess and attention.

Exercise: 6.1

Name : Place me right

Materials : Beans, basket, biscuits, toffee, tin, box.

(Group activity)

Procedure :

The therapist says several commands which have to be followed by the child, in the order in which they were said. The child is instructed to place different objects in different containers.

Eg:

Three containers such as a basket, a box and a tin Can be used in this activity. The therapist tells the child to put the (bean) in the basket, the (biscuit) in the tin and the (toffee) in the box .

The child should put the objects in the correct container.

Exercise 6.2

Name : **Word building**

Materials : None

(Group activity)

Procedure :

This is an excellent activity to assist the child in developing his sequential memory powers. Each child should say a new word in addition to the words already said by the previous child.

Eg:

The first player says

When I went to New York I took a "toothbrush".

The second player must say,

When I went to New York, I took a "toothbrush and a hat".

The third player must say,

When I went to New York, I took a "toothbrush, hat and **a** pen".

This continues until a player misses one of these items or gets them out of the sequence. The child who can recollect the maximum number of items is the winner.

Exercise 6.3

Name : **Word heard**

Materials : Poem or story, list of words

(Individual activity)

Procedure :

A poem or story is read to the child. The therapist then prepares a list of words, some of which appeared in the poem/story and others, perhaps similar

words, that are not in the poem/story. The child or children must say whether they heard a given word in the poem/story.

Eg:

A donkey dressed itself in a lion's skin. Wherever he went the other animals and villagers were afraid of him. Every one thought that he was a real lion. Soon he became bold. But one day some farmers heard him braying. They ran after him with sticks. They beat him to death. Thus, the poor donkey paid the price for his foolishness.

Did you hear these words in the story?

Monkey?	Lion?	Fin?
Animal ?	Village ?	Fire ?
Cold?	Praying?	Bricks?

Note: Children in therapy may be assigned the tasks of composing their own story or poem selection together with a list of words. They may take turns presenting these tasks to other children.

Exercise: 6.4

Name : Remember these words
Materials : None
(Individual activity)
Procedure :

In this game the therapist should say several unrelated words such as deer, candy, pencil, ring. The children should remember these words and supply the correct words when the therapist says a phrase that is related to the word.

Eg:

Something sweet (candy)

Something to wear (ring)

Exercise: 6.5

Name : Word spinner

Materials : Cardboard spinner

(Group activity)

Procedure :

This is an activity to improve long term memory. A large cardboard is covered with cloth. Around the outside edges, some phonemes that are blends or clusters are printed (Eg. cl, st, tr, fl). A spinner is placed in the centre. Children take turns spinning the hand and giving a word beginning or ending with the sound indicated.

The above activity can be further extended by asking the children to as many words as possible with the sound indicated. The child who says the maximum number of words is the winner.

Exercise: 6.6

Name : Detect the difference

Materials : Passages from a story

(Group activity)

Procedure :

In this activity two passages that are very similar, having very subtle differences, should be recorded and played to the child. Initially one passage will

be played and the child has to listen carefully and then the next passage will be played. The child has to identify the sounds or words that are different in the second passage.

Scores can be given for the number of different sounds/ words that are correctly identified. Initially small passages with differences that are gross should be taken. Later the difficulty of the task could be increased.

Eg:

I Passage: The crow was very thirsty. It searched for water here and there. It found a little water.

II Passage: The crow was very hungry. It looked for food here and there. It found a cake.

Exercise:- 6.7

Name. Topsy-Turvy sentence.

Materials : None

(Individual activity)

- Procedure:

The words in a sentence are jumbled and the sentence is read aloud only once. The children have to listen carefully and identify the correct sentence. The complexity of the sentence is gradually increased. Since each sentence will be read only once, the children have to listen carefully and remember the words read to identify the correct sentence.

Eg:

1. Apple ate 1 an

Ans:-1 ate an apple.

2. Went to Sally beach the yesterday.

Ans :- Sally went to the beach yesterday.

Note: In addition to the above activities, the activities in 4.1, 4.16, 4.14 can also be used.

VII) AUDITORY SEQUENCING ABILITY:

Auditory sequencing ability is the ability to identify a series of sounds in correct and respective order. Any deficit in this ability will be manifested, in terms of difficulty in repicturing or rebuilding in order of presentation, sequences of letters, of sounds or units of movements.

Since auditory sequencing ability involves auditory memory also, the activities that improve auditory memory would improve auditory sequencing ability to a certain extent.

The following activities can be carried out to improve the auditory sequencing ability.

Exercise:- **7.1**

Name : Repeat words

Materials : None

(Individual or group activity)

Procedure :

The clinician should say some related words such as apple, plum, peach, banana. The child's task is to repeat the words in the correct sequential order. Gradually increase the number of words to be repeated as the child gains the

skill. Reverse roles frequently. In group work, allow the children to take turns presenting the categories and sequence to be presented.

In the next step, the clinician can present unrelated words and ask the child to repeat them.

Eg. Bus, apple, book, frog, tree.

Exercise :- 7.2

Name : Memory lane

Materials : Newspaper, cloth , basket, toy train, apple, hat.

(Group activity)

Procedure :

This exercise which improves sequencing of words, is enjoyed by young children. Place a 10 foot length of newspaper or cloth on the floor to represent a road. At the end of the road, place several small objects. The therapist should provide the child with a small basket and say, "Walk down the road and pick up, in correct order a train, an apple and a hat". If the child is unable to remember three objects ask for only two until sufficient skill is gained to present three. When the listener returns with the objects in the basket, the therapist will ask, what did you bring? The child should answer in a complete sentence, such as, " I brought a train, an apple and a hat". To encourage verbal expression, the therapist may reverse roles, putting the responsibility on the child for giving the correct directions and for remembering the objects mat were requested.

Exercise :- 7.3

Name : **Listen, remember and perform.**

Materials : Books, chair, table, pen.

(Group activity)

Procedure :

This activity requires the child to perform related tasks. The child has to listen, remember the activities in the correct order and perform them.

Eg :- Pick up your books,

Put them on the chair,

Push the chair under the table.

Once the child is able to carryout the activity with related sentences the same may be done using unrelated tasks.

Exercise :- 7.4

Name : Body laterality

Material : None

(Group activity)

Procedure :

This is an exercise to improve memory and body laterality. Initially the child should be taught to identify the right and left sides of his body. Following this the child is requested to touch his right ear with his left hand or his left shoulder with his right hand or his left eye with his left hand etc.

When the child can perform the above tasks consistently, request him to perform two cross over tasks, which need to be performed simultaneously.

Eg:

Touch your left shoulder with your right hand and your right foot with your left hand.

VIII) FRACTURING ABILITY:

It refers to the ability to identify each discrete sounds in a word. If this ability is affected than the individual will not be able to identify the sounds in **a** word

Activities that encourage the listener to recognize and identify the individual sounds heard in a given word, would be carried out.

Exercise 8.1:

Name : **Form the word chain**

Material : None

(Group activity)

Procedure :

This particular activity is carried out on a group which is divided in to two teams. The two teams lineup facing each other. The first player on one team says a word such as "want" then the first player on the opposite team says word that begins with the last letter of the first worked such as "toy". A point is added to the team's score when a child gives a correct response.

The team with the maximum number of points is the winner. The game should be continued with the teams being asked to say a word starting with the second letter of the first word and so on.

Exercise 8. 2:

Name : Monkey

Materials : Cards

(Group activity)

Procedure :

In this group activity the children are made to sit in a circle. The therapist says the name of an object such as 'bat'. The children have to spell the word i.e each person should say one letter in the order. The first child should say 'b' and the next child ' a' and so on. The child who makes the first mistake will be given the letter in' and if he or she continued to make the mistake he or she will be given the next letter of the word ' monkey'.

The first child who get the word monkey will be given a punishment. The punishment can be funny such as a monkey jumping or dancing ect. The winner could be the child with the least number of letters that make the word monkey.

Exercise 8. 3:

Name : Jack pot

Materials : Domestic objects

(Group activity)

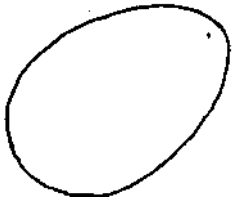
Procedure :

The therapist says the name of an object to the children. Each child should bring the objects starting with letter, that constitute the name of the object.

Eg: if the leader says pen.

PEN

The child can bring Pot, Egg, Nest


The child who brings the objects first is the winner.

Exercise 8. 4:

Name : **Riddle Me- Ree**

Materials : None

(Group activity)

Procedure :

Children love riddles. In this activity riddles are used to teach childrei identify the discrete sounds in a word.

Eg: 1. I am there in ball, but not in all.

Who am I? (Answer: b)

2. I am there in dog but not in edge.

Who am 1? (Answer : O)

Exercise 8.5:

Name : **Select the letter card**

Material : Letter card

(Group activity)

Procedure :

This is a traditional activity that is carried out to work on fracturing ability. The material used are cards with the letters of the alphabets, printed on them. In this activity the therapist says a word slowly emphasizing on the medial vowel. The child has to repeat the word, listening to the vowel, sound and selects the letter card. The therapist then repeats the whole word and asks the child for the initial sound in the word the child has to take the appropriate letter card and places it in front of the vowel. The therapist should then encourage the child to find the letter that makes the last sound. The lesson should continue with the child reading aloud the whole word.

Exercise 8. 6:

Name : Spelling Mnemonics

Material : None

(Group activity)

Procedure :

Children have always been fascinated by word mnemonics. This particular mnemonics would help the children in remembering the spelling of the word and would aid in enhancing their fracturing ability. The children can also be encouraged to create mnemonics for difficult words. The therapist encourages the child to remember the sentences.

Eg: Familiar : There is a liar in familiar

Cemetery : Watch the e's in cemetery.

Balloon : A balloon is like a ball.

Separate : there is a rat in separate.

Almost: Almost always spelled with one 1.

Arithmetic : A rat in the house may eat the ice cream (The first letter of each word in the sentence would give the spelling of the word).

IX) BINAURAL SEPARATION:

It is the ability to process an auditory message coming to one ear while ignoring a different message presented to the other ear at the same time. The behavioural symptom of binaural separation deficit can be difficulty hearing in background noise when more than one person is talking at the same time.

Binaural separation is closely associated with auditory attention since attention implies a state in which the individual engages in the task of listening and responding to a specific stimulus while excluding others. Hence, the activities that are used to improve auditory attention in the presence of an extraneous stimuli, can be used to enhance binaural separation.

Exercise: 9.1

Name : Repetition in noise

Material : Record player or radio

(Group activity)

Procedure :

This activity involves the therapist saying two or three words while a soft background sound is heard from a record player or radio. The child has to listen and repeat the words correctly in the presence of gradually louder extraneous noise. When the child is able to repeat the words correctly he is made to listen and repeat short sentences in the presence of noise.

In the next step, is a story can be told against the background sound and questions about the story can be asked after the story has been told. Once the child is able to carryout the activity, the intensity of the background noise can be increased such that the signal to noise ratio is zero.

Note: All the activities under auditory attention can be carried out for binaural separation in the presence of an extraneous noise.

X) BINAURAL INTEGRATION:

Binaural integration is the ability to process information presented to both ears simultaneously, when the information presented to both ears are different. An individual with deficit in binaural integration will not be able to integrate or process information from morefhan one source at a time.

There have been several environmental adaptations that have been suggested to improve the listener's access to target auditory information, while decreasing the competing signals. It is not possible to use these suggestions in all the situations. Hence, auditory training activities should be carried out to aid the listener in focussing the attention to the auditory signal coming from both the ears.

Exercise: **10.1**

Name : **Identify** both

Materials : Two record players/ Two radios

(Individual activity)

Procedure :

The following exercise is used to enhance binaural integration ability. For this activity two record player or radios are required which are kept on either side of the child. This activity can be carried out in different steps.

Step -1 (Both ears: Familiar words)

In this step, simple words which are used daily should be selected **and** these words should be presented through the record players. The two different words should be presented at the same time through the two record players **and** the child should identify both the words. Scores should be given for **the number** of pairs of words correctly identified.

Step: II (Both ears : Familiar sentences)

This step is similar to the previous step except that two different sentences, which are familiar to the child are presented. These sentences can be from a rhyme or from a familiar story and the child has to identify both the sentences.

Step: III (One ear : Familiar word, other ear : unfamiliar word)

In this step, a familiar word is presented to one ear while an unfamiliar word is presented to the other ear. The child has to identify both the words.

Step: IV (One ear: Familiar sentence, Other ear: unfamiliar sentence)

As done in step III, a familiar sentence is presented to one ear while an unfamiliar sentence is presented to the other ear. The child has to identify both the sentences.

Step : V (Both ears : unfamiliar words)

Here unfamiliar and difficult words should be presented to both ears. The child's task is to identify these words. If the child is not able to identify them, the therapist can read out these words once before presenting them.

Step VI (Both ears : unfamiliar sentences)

When the child has mastered the previous step, two unfamiliar sentences which may be related or unrelated, have to be identified by the child.

Scores can be given for the correct number of words or sentences identified and token reinforcement can be given.

XI) REAUDITORIZATION:

It is the process by which the production of sound is remembered and the production is practiced in the mind before it is said aloud. Auditory memory is involved to carry out this activity.

Reauditorization is also one of the critical steps in speech correction. To train regarding reauditorization, the therapist produces a sound and asks the child to remember and practice it in his mind. Once the child can do this he can be made to practice alone and aloud.

Exercise : **11.1**

Name : **Description**

Materials : None

(Individual activity)

Procedure :

In this activity, the teacher would say a word, then repeat every phoneme in the word. After each phoneme is produced the teacher encourages the child to remember the production of the sound and practice it in his mind. Then the child has to answer a few questions about the sound after which the child could say the sound aloud.

Step: I

The therapist says the word 'ball'

Step II:

The therapist says the first sound of the word **'b'**

Step HI:

The child is encouraged to remember the production and practice it in his mind.

Step IV:

The child has to answer the following questions

a) Is the sound similar to 'p'

Yes/No.

b) Is the sound found in the word book

Yes /No.

Step V:

The child has to say the sound aloud.

Exercise : **11.2**

Name : **Palindromes**

Materials : List of words

(Individual activity)

Procedure

This is an activity for reauditorization. A palindrome is a word that reads the same backward and forward. In this activity the therapist reads a list of words

and the children have to identify which words are all palindromes. This activity improves reauditorization since the child has to remember the spelling of the word and has to hold it in his /her auditory imagery to find out whether the word is a palindrome.

Eg: Level Mom

Eve Nut

Hannah Tat

Knife Bjb

Bulb

XII) ACOUSTIC CONTOUR RECOGNITION:

It refers to the ability to recognize acoustic contours i.e the ability to extract and utilize prosodic aspects of speech such as rhythm, stress and intonation. Individual whose acoustic contour recognition ability is affected will have difficulty in recognizing and using prosodic aspects of speech and difficulty in extracting keywords from a spoken message. Strategies such as reading aloud with emphasis on intonation, stress and rhythm are followed to work on the acoustic contour recognition.

Exercise : 12.1

Name : **Pattern Discrimination**

Materials : None

(Individual activity)

Procedure :

In this activity the therapist presents, two series of claps and the child has to say whether the two series had the same number of claps or not. The activities can be carried out in the following order.

Step I:

The patterns are presented by the therapist in pairs.

Eg:

11 111 --> different

Clap

11 11 same

In this step the child has to just say whether they are same or different.

Step II:

In this step the child has to imitate the pattern.

The pattern should be altered in terms of speed, relative loudness or rhythm. Speed can be altered by increasing or decreasing the interval between taps. Perception of relative loudness can be taught by placing emphasis on one or more claps in the series when compared to the other. Rhythm can be taught by including silent intervals.

When the child is able to accurately differentiate and identify these different patterns, verbal sounds can be introduced. If required instead of claps, the therapist can tap.

Exercise: 12.2

Name : Prosody training

Materials : None

(Individual activity)

Procedure :

Prosody training, which aids in the acoustic contour recognition, is taught in this exercise. The prosody training can be done in different steps.

Step 1:

In this step words with stress in different syllables should be presented and the children should be asked to say whether both the words are sounding the same or different.

Eg:

Convict Convict

Object Object

When the child is able to identify whether the words are same or different, the child should be made to imitate these words.

Step II

In this step, sentences with stress in different words should be presented.

Eg:

Don't touch that book

Don't touch that book

Initially the child should be made to say whether they are same or different. Following this the child should be made to identify the word in which

the stress is given. Finally, the therapist can say how the meaning of the sentence varies when the stress is given to different words.

Eg:

Don't touch that pen.

It means that the child can touch any other item but not the pen.

Don't touch that pen.

This means that the child should not touch that particular pen.

These are some of the auditory training activities that can be used to work on the different auditory perceptual subskills. These activities can be modified based on the age, linguistic and cultural background of the child. The therapist can also develop similar activities.

Apart from the auditory training activities, signal enhancement procedures and linguistic and metacognition intervention are also done for individuals with CAPD which are explained in the following section.

2. Signal Enhancement Procedures.

The processing of complex sounds poses a challenge for a child with CAPD even in an ideal situation. It is even more difficult when the listening environment is made less favourable. Hence, many steps need to be taken to improve the quality of the signal and listening environment to enhance the processing of speech in these less than ideal listening conditions.

A) Enhancement of Signal Quality:

To improve the quality of the signal the following may be carried out:

- The speaker should speak clearly with an attempt to produce every word, phrase or utterance in a precise and clear fashion.
- Speaking rate should be reduced.
- The sentences should be short and pauses should be introduced between sentences to help the students catch-up and the children should be give more time to respond to what they heard.
- The children should be informed about what the speaker is going to talk about before the speaker begins talking.
- Environmental cues such as objects, pictures, diagrams, maps and overhead projectors can be used to help convey meaning.
- The keywords and phrases should be emphasized by producing them louder and longer.
- Pronunciation practice should be included while teaching new vocabulary.
- The students should be encouraged to repeat directions or instructions upon hearing them for better retention and recall.
- Facial expressions should be watched for any indication for loss of comprehension.

B) ***Modification of Listening Environment:***

The following steps can be taken to modify the listening environment. A lot of these modifications will not be different from what is used with hearing impaired children with peripheral problems.

- Optimum signal-to-noise levels should be maintained which can be done through proper acoustic treatment of the classroom and the furnitures in the classroom.

- Students with CAPD should be offered alternative spaces to work in a quiet area when it is appropriate.

- Preferential seating should be given and children with CAPD should be kept near the speaker.

- Assistive Listening Devices (ALD) and frequency modulated (FM) devises can be helpful in improving classroom listening conditions. These devices are designed to enhance the acoustic signal over background noise by the use of a remote microphone.

3. Linguistic and Metacognitive intervention

The management procedures for linguistic, cognition and metacognition have been incorporated in a comprehensive management plan in an effort to assist the individuals in overcoming the effects of CAPD. Although here the efforts are directed at improving linguistic or cognitive skills, it is not uncommon to see some improvements in auditory perceptual skills as a by product of many of these intervention strategies or procedures. The management procedures for linguistic intervention target phonological awareness morphology, vocabulary, prosody. The management procedures for metacognition target contextual derivation, discourse cohesion devices and schema induction.

Linguistic Intervention

Phonological awareness refers to the ability to recognize and manipulate the various sound units characteristic of the language (eg. Phonemes, syllables

and words). This type of processing difficulty is common in children with CAPD, since the processing of speech segments is based on the ability to process brief acoustic events that are changing rapidly in their spectral, temporal and intensity characteristics. Phonemic awareness is related to phonological processing and it refers to the individual's ability to manipulate the individual sounds in words that is phonemes.

The skills that are targeted during phonological awareness training include auditory discrimination, sound blending, segmentation, phoneme identification, recognition of sound position in word and rhyming.

The next skill that is targeted is morphology, since morphological markers are frequently not perceived by children with CAPD. The reason may be because the morphological markers are unstressed and weak acoustic representations within the speech stream.

The acquisition of new lexical items is often challenging for a child with CAPD. The training for vocabulary should encourage the child to use a variety of sensory input modalities (sight, hearing and kinesthetics) and to assist in the processing acquisition and storage of new information.

Prosody or intonation is an important linguistic marker that can often change the meaning of an utterance. Children with CAPD are deficient in processing the acoustic envelope of an ongoing acoustic stream and therefore are unaware of the subtle differences in intonation patterns. Training should focus on contrasting intonation patterns to foster recognition of the alternative semantic interpretations of the two sentences which may have otherwise identical phonological, syntactic and semantic structures.

Metacognition Intervention

Metacognition refers to the processes through which individuals reflect on the demands inherent in an activity or situation, identify the variables that can affect performance and use this information and knowledge to plan, monitor and regulate behaviours such as attention, memory, listening, comprehension and the use of language.

Normally the metacognitive processes are automatic and relatively effortless and they are activated with little conscious effort, whereas for children with CAPD the metacognitive processes require a voluntary focus on the cognitive demands associated with the context or behaviour, a recognition of the individual's goal with respect to the context or behaviour and the mental processes needed to, meet both the demands and goals. Hence the strategy instruction is often required with many of these individuals.

The strategies have been assigned acronyms which helps the user recall the steps. RIDER is a strategy designed to assist the individual in improving reading comprehension. This is accomplished by encouraging the individual to form mental images of the material being read.

The essential steps include

R= Read the first sentence

I = make an Image of the material read.

D = Describe your image

E = Evaluate your image for completeness

R = Repeat the earlier steps for the next sentence.

Contextual derivation is also affected in individuals with CAPD. Context can be used to derive word meaning and enhance message comprehension whether the message is spoken or in print. In context - derived comprehension instruction the individuals are encouraged to use their world and linguistic knowledge to deduce word meaning and achieve message comprehension.

For a child with an auditory processing problem to get maximum benefit from a therapy program it necessary to initially make modifications in the listening environment prior to starting auditory training activities. A combination of auditory training and metacognirive intervention would also be required.

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