

ABSTRACT

All children learn skills at a certain age. During early childhood the child's sensitive brain is ready to learn. If the opportunities for learning are missed it will be more difficult to learn the skills later on. The present paper focuses on neurocognitive functions that are involved in the processing of auditory information (attention, memory, language representation).

INTRODUCTION

When sounds strike the ear drum, the acoustic signals of the sounds are changed into neural signals. These neural signals pass from the ear through complicated neural networks to various parts of the brain. Hearing the sounds is a complex process and the ability to detect the presence of sounds is only one part of the processing that occurs within the auditory system. Many individuals have no problem in detecting the presence of sound. Some individuals may have certain types of auditory difficulties like

1. Inability to understand conversation in noisy environments.
2. Inability to learn new vocabulary etc.

Hence normal language development will be affected. These individuals appear to hear normally, they do not have trouble in detecting the presence of sounds or recognizing speech in ideal listening situations.

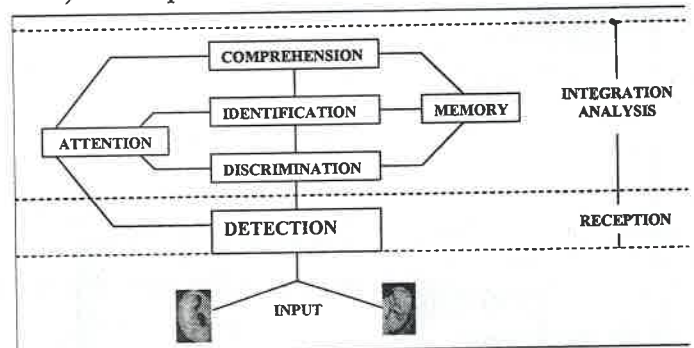
Central auditory processing refers to the reception, analysis and integration of auditory material within the central nervous system. Auditory information is presented in the parameters of time, frequency and intensity. Individuals who have difficulty in this area are considered to have a central auditory processing problem, also called central auditory dysfunction or auditory perceptual problem. Disruption in the function of the central auditory system results in emotional problems, hyperactivity, speech problems or hearing loss in children. The development of dominance in the cerebral system occurs in the first 5 years of life, but the system remains flexible in the characteristics of this dominance through age 12 to 13.

Katz, Stecker and Henderson (1922) described central auditory processing as "What we do with what we hear". It is the ability of the brain to process the incoming auditory signals. The prevalence of central auditory processing disorder in children is estimated to be between 2 and 3 percentage (Chermak and Musiek, 1997) with it being twice as prevalent in males.

BASIC LEVELS OF FUNCTION IN PROCESSING SOUND

The four basic levels of function in processing sound are as follows.

- 1) Detection
- 2) Discrimination
- 3) Identification
- 4) Comprehension



A CENTRAL AUDITORY PROCESSING MODEL LEVELS OF FUNCTION

Detection : It is the most elementary level. The significant function is to detect the sound being present.

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The sound must be above the threshold of hearing in order to be processed.

Discrimination : The central nervous system begins to analyze the sound and distinguish certain encompasses characteristic of it. Discrimination encompasses differences in frequency (e.g. between p and b), differences in intensity (as in loudness and softness and differences in temporal features - as in time differences)

Identification : The sound is further analyzed and is now recognized in terms of its relationship to past sounds heard.

Comprehension : Recognition and identification is sustained over a period of time in this stage. The final stage of integrating the sound with other information in the central nervous system occurs.

All the four levels in the system operate as a whole or as a feedback loop. Each level may influence and be influenced by the levels both above and below it. The inter relationship between the levels of auditory function is an important feature in facilitating auditory inter relationship learning.

Attention and memory are functions of the central nervous system that serve the auditory system as well as the other sensory systems. Attention may be considered at two levels: reflexive and cognitive. The reflexive refers to the constant alertness of the nervous system to incoming stimulus. Cognitive attention implies conscious awareness of focus on incoming stimuli. Attention is a significant factor at all levels of function in the auditory system, from detection through comprehension.

Memory refers to the storage of information and is considered in terms of duration, both short and long term. Discrimination, identification and comprehension are influenced by memory. At the level of discrimination memory is short term. At the higher level like identification and comprehension, memory is long term.

In auditory processing, the central system is required to extract the meaningful features of sound stimuli to integrate the intensity, frequency and temporal relationships of sound sequence in each ear, to monitor self-production of sound and attend to and store information. The auditory system helps the human being

in receiving, sorting and codifying speech in oneself and in others

FACTORS INFLUENCING AUDITORY EVENTS

Auditory events depend on the following factors.

- 1) The level of maturity and intactness of the listener's central nervous system
- 2) The general psychological and physical well being of the listener
- 3) The motivation and interest of the listener
- 4) How recently the auditory event occurred
- 5) How loud it was
- 6) How constantly it persisted
- 7) How long it lasted
- 8) How complex it was
- 9) How much distraction was present at the time it occurred

A normal 6 months old child can detect, discriminate, recognize and understand speech in the presence or absence of distraction, can localize and can temporally integrate speech from both ears into meaningful units. Though he does not have the motor co-ordination to articulate words, he can monitor his own communication output. Auditory skills will be refined and elaborated upon as the child matures so that increasingly complex performance becomes possible with maturity.

CHARACTERISTICS OF A CHILD WITH A CENTRAL AUDITORY PROCESSING

Problem

Some of the common behavioral characteristics are noted in children with central auditory processing disorders.

Faint Speech

The child may have difficulty comprehending faint speech.

Phonemic content

The child may have difficulty understanding the phonemic content of speech even when speech is comfortably loud. He may confuse words that sound similar e.g.: bet and best.

Sequencing Sound

The child may be unable to tell which sound was heard first if the two sounds are reasonably close in time of onset. Moreover the child may have difficulty in learning names of the days of the week, the alphabet and one's home address. Another type is word finding difficulty.

Language Components

The child may have difficulty recognizing and comprehending the necessary components.

Listening

The child may be unable to comprehend all that the teacher is saying, if there are other sounds or movements in the classroom.

Sound Localizing

The child may have difficulty localizing sound immediately requiring a longer time to locate sound in space.

Reading

The child may have difficulty learning to read.

Speech and language development

At early school age and beyond, there will still be evidence of receptive and expressive language problems and articulation problems.

BEHAVIOR

The child may show signs of low frustration tolerance, short attention span, withdrawal, irritability, hyperactivity, poor self-concept and inconsistency etc. If any of these behaviors are noted the child may have central auditory processing disorders and there is a need for appropriate testing. Some of the tests are 1. Behavioural tests 2. Dichotic speech tests and 3. Temporal patterning tests etc. which help to assess the various auditory function deficiencies of the brain.

The above factors may influence the development of the child's total auditory capability and thereby other aspects of his mental and physical development.

INTERVENTION

Weakness in one or two of the above characteristics will not lead to any central auditory processing problem. The child with only one or two of these characteristics

can compensate using the remainder of his central auditory system which is **Article** normal. If the child has several of these characteristics he is at a risk to achieve his potential in the emotional, intellectual and physical spheres.

Hence intervention is necessary for optimal development of the child. The first essential stage is to determine whether the child has central auditory processing problem. Evaluation will be done by a number of specialists as follows.

1. Audiologist to determine central auditory processing ability of the child
2. A speech and language pathologist to determine competency in receptive and expressive language function.
3. A psychologist to determine the intellectual function and areas of strength and weakness. It is important to consider the parents' evaluation of their child as they need to be an integral part of the process of evaluation and the therapy.

To help the child to overcome this disorder factors like age of the child, the co-existence of other disabilities, problems and availability of other resources need to be considered. The approaches to remediation fall into three main categories:

1. Enhancing the child's language and cognitive resources
2. Enhancing the child's auditory perceptual skills
3. Improving the quality of auditory signal.

The following strategies can be followed

- Ø Children can be provided with personal assistive learning devices that will enhance the teacher's voice and reduce the competition of other noises and sounds in the class room.
- Ø Acoustic modifications can be made to the class room like carpeting, acoustic ceiling tiles, and window treatments. This will help to minimize the noise affecting the child's ability to process speech in the educational setting.
- Ø Teachers and parents should speak clearly, providing preferential seating, using visual aids to supplement auditory information.

Continued on page 12