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Each person is an individual and has a unique psychological profile, biochemistry, developmental and social history. As such, advice will not be given over the internet and recommendations and interventions within this website cannot be taken as a substitute for a thorough medical or allied health professional assessment or diagnosis.

Auditory Processing Disorder

Previously known as Central Auditory Processing Disorder

This article is based on extracts from "From Central Auditory Processing Skills to Language and Literacy". From the Speech Pathology Australia, National Conference, Adelaide, May 8-12, 2000.

Article QUICK LINKS :

INTRODUCTION

Children and adults with auditory processing disorder (APD) have problems comprehending speech. The concept of APD is often difficult for parents, educators and other professionals to understand. This is because individuals with a auditory processing disorder have normal hearing but parts of the brain which analyze and interpret the sensory information from the ears, do not function appropriately.

Before we proceed further, the important differences between hearing and listening need to be clarified. Hearing is a physiological process involving the detection of sound. Listening on the other hand, involves an active attentional process (perceptual cognitive) based on binaural hearing. It develops later in childhood and is influenced by extrinisc and intrinsic factors e.g., noise, fatigue, anxiety, motivation and interest, speed of processing.

AUDITORY PROCESSING (AP)

Auditory processing (AP) has been defined in a number of ways. Some of these include:

"Auditory processing involves attention to detection, and identification of the signal and decoding of the neural message" (Katz and Stecker, 1992)

"The way our central mechanisms receive, perceive, decode and utilize speech/sound signals" (Lasky and Katz, 1983)

"The neural processes involved in obtaining information from signals presented in the auditory modality" (Stark and Bernstein, 1984)

"Central auditory processes involve the deployment of nondedicated, global mechanisms of attention and memory in the service of acoustic signal processing" (ASHA, 1996)

AUDITORY PROCESSING DISORDERS (APD)

Likewise, there are several definitions for APD. The simplest definition is a deficit in the perception or complete analysis of auditory information due to central nervous system dysfunction, usually at the level of the cerebral cortex" (SPA National Conference 2000).

Other definitions include:

"A breakdown in auditory abilities resulting in diminished learning (e.g. comprehension) through hearing, even though peripheral auditory sensitivity is normal" (Whitelaw,1997)

"Deficits in the information processing of audible signals not attributable to impaired peripheral hearing sensitivity or intellectual impairment. Specifically refers to limitations in the ongoing transmission, analysis, organization, transformation, elaboration, storage, retrieval and use of information contained in auditory signals" (Trace, 1993)

"CAPD is not a label for a unitary disease entity, but rather a description of a heterogeneous group of functional deficits which may reflect a loss of function, disordered function, or release of function" (ASHA, 1996, Chermak and Musiek, 1997)

"CAPD results from dysfunction of processes dedicated to audition; however, CAPD also may co-exist with a more global dysfunction that affects performance across modalities (e.g. attention deficit, neural timing deficit, language representation deficit)" (ASHA, 1996, Chermak, Hall, and Musiek, 1999).

APD becomes more apparent in poorer listening environments such as open classrooms and background noise. Children may not show the problem until they begin school and have to actively listen in order to learn. Not all APD children have the same problems. Some have problems sequencing speech sounds; others have problems understanding speech in background noise, and in some the timing appears off. In order for children to adequately decode speech they

need to be able to process auditory information in less than 100 milliseconds. Many children with APD have processing speeds in excess of 400 msec and sometimes as slow as 700 msecs. These children have great difficulty processing the order of sounds and hence spelling and comprehension will be compromised.

No one really knows why this deficit in sensory processing in the brain occurs. Birth and developmental histories are often unremarkable and there is no evidence of brain damage. In some children, ear infections have been implicated as a factor. Neuromaturation of the auditory system is often delayed in many children with APD. Some professionals consider that APD may be a form of learning disability. Children may or may not have a speech disorder or language problem. A common presumption is that a child who has APD should have a language disorder. While this can occur, it is often not the case. What is most striking is a child of normal intelligence working far below their ability at school and having difficulty at home.

COMMON CHARACTERISTICS OF CAPD

(Bellis, 1996, Chermak et al, 1999)

- Child behaves as if peripheral hearing loss is present; even though hearing sensitivity is normal
- Child may refuse to participate in classroom discussions or may respond inappropriately
- Child may be withdrawn or sullen
- Child may ask for frequent repetitions, say "what" or "huh" a lot, or say, "I didn't hear you"
- Child may show extreme auditory inattention and may have trouble paying attention
- Child may be easily distracted
- Child requires high degree of external organization in the classroom
- Child may have trouble following complex auditory directions or commands and localising sound
- Verbal IQ scores are often lower than performance scores
- Child demonstrates significant scatter across subtests assessed by speech/language and / or psycho educational tests, with weaknesses in auditory dependent areas
- Child may exhibit poor reading and / or spelling skills
- Child may have fine and / or gross motor skill deficits
- Child may exhibit poor singing and music skills

- Child may have significant history of middle ear pathology
- Positive family history for CAPD and / or ADHD and / or learning disabilities
- Quite often children with CAPD are misdiagnosed as ADHD therefore an early differential diagnosis is vital.

CHILDREN WHO ARE CANDIDATES FOR AN APD ASSESSMENT INCLUDE THOSE WITH:

A hearing or listening disability which includes:

- Difficulty following instructions
- Inattentiveness
- Distractibility due to background noise
- Poor memory for auditory information
- A history of chronic otitis media with associated conductive hearing loss
- ADHD or ADD

Poor general academic performance despite:

- Normal hearing sensitivity
- Normal non-verbal intelligence
- Normal visual processing skills
- A medical history especially with heightened risk of neurological sequealae eg. bacterial meningitis, head injury, neurotoxic exposures, antidepressant medication (Prozac)
- A family history of developmental speech difficulties, non-verbal learning difficulties and hearing loss

There is a high rate of comorbidity between CAPD and the following disorders:

- Learning Disabilities
- Dyslexia
- Attention Deficit Disorder with or without Hyperactivity
- Developmental disabilities/mental retardation
- Sensorineural hearing loss

There are many subtypes of APD. These include:

AUDITORY DECODING DEFICIT / DECODING

This subtype is often considered to be the "classic " manifestation of APD. The Auditory Decoding Deficit sub profile may be the behavioural manifestation of poorly formed neural representation acoustic features, particularly those important for phonemic discrimination (Koch, et al, 1999) and auditory closure. Children in this category are often described by their parents and / or teachers as having hearing difficulties even though peripheral hearing is-found to be normal. These children process information in a way that is slow and inaccurate. This inefficiency in processing means that they are working harder to interpret what they hear.

OUTPUT-ORGANISATION DEFICIT / ORGANISATION

Children with output-organization deficit have trouble organising, sequencing, recalling, and / or expressing an answer. These children may have listened to, analysed, correctly connected and pulled together the information but still have difficulty responding correctly. In general, children with output-organization difficulties often demonstrate difficulty on tasks where success is dependent on motor and / or planning skills.

ASSOCIATIVE DEFICIT / TOLERANCE-FADING MEMORY

Children with this sub profile have difficulties applying the rules of language to sounds they hear. These children often have an intolerance for background noise, and their understanding of speech/language declines markedly when noise is present. Often these children have early academic performance that- is grade or age appropriate but as the language demands in the classroom increase these children have more and more difficulty. Children in this sub profile often are undiagnosed until 3r and 4th grade. (J. Ferre, 1997)

INTEGRATION DEFICIT

Children with this sub profile often demonstrate difficulty across modalities with any task that requires efficient interhemispheric communication. These children have problems tying together auditory and visual information. They frequently exhibit long delays in responding.

PROSODIC DEFICIT

Children in this sub profile often exhibit little or no expressive affect and may be described as "flat" or "monotonic" speakers and readers. They often have difficulty with pragmatic communication skills, sequencing, social judgment, gestalt patterning and spatial abilities (Tomkins, 1995). In other words these children may demonstrate a difficulty or inability to perceive the prosodic cues that underlie the communication of humour, sarcasm, question forms etc, that rely heavily on intonational cues to gauge intent.

Auditory processing skills and speech perception are foundational skills for the emergence of phonemic awareness and in the broader sense phonological awareness. These skills are important building blocks to literacy. Many children with APD are slow and inaccurate at processing phonemic information which means that they are working harder to interpret what they hear.

Therefore teachers can assist children with APD by :

- Making every effort to eliminate extraneous noise. Open classrooms are a very poor environment for these children. It has been found that small, enclosed classrooms work best as long as they are in a quiet part of the building away from traffic and other noises.

- Moving closer (a better signal to noise ratio) and obtaining their visual attention (by touching him or in some other manner such as a predetermined signal) when new ideas are being introduced, or when giving instructions or changing subjects. Individuals respond better when attention is directed at the speaker and the CAPD child needs additional prompting in order to have attention focused properly.

- Seating the child in the front of the class where he or she has good visual reception of the area where most teaching is done. Avoid seating by open doors or windows. Make sure the child can see the speaker's face.
  Avoid strong shadows which hid the face. Standing in front of windows on a sunny day will hide the face.

- Allowing the child to use earplugs or muffs during quiet study periods.
  The earplugs will reduce extraneous noise and may allow the child to concentrate on his work. If all the children in a class can use them, then it will prevent one child from being singled out as different.

- Providing additional written or visual material. For some children, outlines of material to be presented verbally may help. Oral changes to instructions printed on the board or handed out need to be provided in writing to CAPD children.

Since homes are also noisy places, parents can apply the same basic rules as for the classroom. These rules are :

1. Obtain visual attention

2. Get rid of background noise and other distractions.

3. Seat the child close to the speaker.

Therefore studying with the television or radio playing in the background is not recommended for children with APD. If the child is not paying attention or asking for information to be repeated, obtain visual attention before speaking. Don't try to carry on a conversation across large rooms, while the TV is playing, or if the child is in another room. This will only frustrate both of you. If you want to carry on a conversation, be in the same room with the same purpose - to talk with each other.

If a child is unable to follow simple commands or directions in the proper order, be specific.

1. Break down instructions into simple, concise, concrete actions.
   "Wash your hands" may be better than "Go clean up".

2. Be brief. Long sequences of commands may be too much. Rather than say, "Go in the house, hang your coat up, pick up your toys in the living room, don't turn on the TV, and make your bed" tell him/her to do one or two things then return to you for more instructions.

3. Slow down the rate of presentation to allow more time for processing and comprehension of the instructions. CAPD children need more time to process and organize the information.

4. Develop compensatory methods to check that instructions were understood. One method used by the hearing impaired is to repeat back to the speaker what was heard. When this is done, the speaker can identify errors and correct them. The speaker should not simple repeat the message in a louder voice.

5. Confer with the child about new information or material. If it is not understood, review it again and elements to aid understanding.
   Use of gestures and visual aids is encouraged.

Away from home, be aware of the environment. In noisy places, such as a shopping centre, the child may not hear your instructions on where to be at what time. It is better to minimize background noise by moving to a quiet place rather than yelling. Or you can rehearse with your child before you arrive at the place where you will meet and at what time.

Your child may have problems at church, scout halls and other places of gathering. Many halls have hard, reflective walls resulting in reverberations. The normal auditory system will merge reverberations into a single auditory image. The APD child may not be able to do this. The suggestions given above for the classroom will apply to any meeting place. Also be aware that your child may not like to go to parities, meetings and other gatherings because they are difficult and frustrating. Avoid subjecting him or her too often to this type of situation.

Adults (scout masters, swimming coaches, etc.) working with children with CAPD need to:

- Be Supportive
- Be Understanding
- Experiment by keeping a log of what works and doesn't
- Slow down, as rapid presentation of many facts doesn't help. Speech patterns need to be modified and simpler grammatical constructions need to be employed.
- Maintain visual contact, as this will help the child maintain attention.

Teach the child to be responsible. This means encouraging the child to check that he "heard" all of the instructions. If a plan of action was discussed, then changed, check that the child is aware of the change. This is important for homework assignments, family plans, trips to the store, and other projects. Write information down. Speech is considered to be very redundant, but some parts of it have even less information for the child to rely on. Numbers, dates, addresses, and names are of this category. A person's phone number can be very hard to catch if spoken just once and rapidly. Encourage the child to ask that the speaker write down this type of information.

Most of us have some degree of problem hearing under poor listening conditions. The APD child has more of a problem. It has been suggested that APD is a multidimensional entity with far-reaching communicative, educational, and psychosocial implications for which differential diagnosis not only is possible but also is essential to an understanding of its impact and to the development of efficacious, deficit- specific management plans" (Bellis, Ferre, 1999).

Therefore the assessment and management of APD needs a transdisciplinary approach including:

- Audiology
- Speech / Language pathology
- Sound therapy
- Education
- Psychology
- Medicine
- Diet / Nutrition
- Physical therapy
- Occupational therapy
- Optometry

It is important to note that the audiology part of the comprehensive assessment is of prime importance. It is not enough to merely test four or five frequencies as is usual in class screenings in Australia. Adequate hearing is different from effective listening. Furthermore, during the language acquisition phase (0-7 years), some frequencies used in English require more sensitivity than the usual 0-20 decibel range, which was established as normal adult hearing when the Bell Telephone Company was marketing their equipment in the early 1900's. This range is meaningless for the acquisition of high frequency sounds required for spoken English in the critical period of auditory development in children. Temporal ordering tasks, monaural low-redundancy speech tests, Dichotic speech tests, electrophysiological tests (late evoked potentials, P300, etc.), speech and language tests (auditory attention, perception, discrimination and conceptualisation, phonological awareness, expressive and receptive language etc.) are vital components of an assessment for APD.

Recent studies have examined the improvement in auditory processing abilities with intensive auditory stimulation and training (Jirsa, 1992; Merzenich et al., 1996 and Tallal et al., 1996). This promising research suggests that direct interventions (i.e. auditory training and more traditional language therapies) can significantly improve auditory processing abilities and has provided a stronger basis for the implementation of therapy strategies in a comprehensive approach to the management of CAPD.

FURTHER READING SUGGESTIONS

- Samonas Sound Therapy

PRODUCTS FOR SALE

- The Listening Program

For more information or to make an appointment or to purchase the Listening Program please contact us on (02) 9637 9998 during business hours.

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