

# Auditory Processing Disorders (APD)



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**Summary:** Auditory Processing Disorder (APD), or Central Auditory Processing Disorder (CAPD) is a condition which makes it more difficult to hear, especially in noisy situations, even when a hearing test is normal. This can cause problems with learning, mood and behaviour, and can even mimic other conditions such as attention deficit disorder (ADD/ADHD).

## Introduction

Auditory Processing Disorder (APD), or Central Auditory Processing Disorder (CAPD) is a condition which affects how people hear the sounds around them. APD makes it more difficult to hear, especially in noisy situations, even when a hearing test is normal.

If you or your child has APD, you may notice some of the following:

- Difficulties hearing when there is background noise despite normal hearing.
- Difficulty following multi-step, or multiple instructions.
- Difficulty following rapid or accented speech.
- Lower school achievements than would be expected, given results of a cognitive evaluation.
- A history of multiple ear infections.
- Delays in reading and spelling noticed since Grade 2 or 3.

If you or your child has noticed 2 or more of these symptoms, an APD may be present. APD can only be diagnosed by an audiologist who has experience with APD testing.

## Cases

Sam is a 8 year old boy who is performing well in school except in reading and spelling. He can read familiar words, but does not seem to know how to attack unfamiliar vocabulary. He always needs the instructions repeated in class, and has difficulty focusing in gym class. He has difficulties paying attention during group activities, but not when he is alone with the teacher. People wonder if he has attention deficit disorder.

Mary is in her 50s. She has been unhappy for some time because she feels that her family is upset with her. Her husband seems irritable, but denies he is angry with her. Friends seem to react negatively during get-togethers. She is wondering why her life is so miserable, and is considering counselling.

Joe prefers to hang out with adults rather than kids his own age. He gets teased often, and teachers notice that he does not get along well with the other children. His mother remarks that Joe takes things literally, and is confused by jokes. He speaks in a monotone. He has not met all the criteria for Aspergers Syndrome.

Mark is struggling in school. His teacher uses a lot of handouts but Mark has difficulty following along, more so when the classroom is noisy. His parents think he ought to be getting better grades because he seems smart enough. Even gym class poses problems when he has to use both hands or feet during activities. Mark reports that he has difficulties picking up the lyrics to songs, which is a source of great amusement to his friends.

## What is APD?

Auditory Processing Disorder (APD) is a condition where someone has normal hearing, but the auditory system does not faithfully bring information to the brain. In other words, the brain is unable to properly process the information it has heard, and thus the person ends up having trouble understanding what is heard.

An older term for this is Central Auditory Processing Disorder (CAPD), however because all auditory processing has to occur centrally (i.e. inside the brain), it is thus redundant to use the term 'central', and hence the simpler and shorter term "auditory processing disorder (APD)".

When we talk of auditory processing, we must consider:

- 1) The speaker,
- 2) The message itself, and
- 3) The recipient with the auditory processing disorder.

A good analogy to make the concept of auditory processing clear is to imagine speech as an inter-office memo:

- 1) The writer of the memo (or the speaker) puts his thoughts down in a clear, organised manner.
- 2) The memo (the spoken message) then has to find it's way to the recipient (the child with auditory processing disorder). On the way, however, the memo gets coffee stains on it, gets crumpled, and stepped on.
- 3) The recipient no longer has a clear, easy to read message. It takes longer to read (delay in processing), some of the letters are blurred (like distorted speech), and some covered by coffee stains (akin to background noise covering speech sounds).

It is easy now to imagine how difficult it is for a child with auditory processing disorder to follow everyday speech. It can be too rapid, too distorted, or too masked by noise to follow.

**Because so much of our day-to-day communication depends on sound information (spoken language), auditory processing problems can thus cause significant problems at school, work, home and relationships.**

According to the American Speech-Language-Hearing Association (ASHA) (2005). (Central) Auditory Processing Disorders [Technical Report]:

*Broadly stated, (Central) Auditory Processing [(C)AP] refers to the efficiency and effectiveness by which the central nervous system (CNS) utilizes auditory information. Narrowly defined, (C)AP refers to the perceptual processing of auditory information in the CNS and the neurobiologic activity that underlies that processing and gives rise to electrophysiologic auditory potentials. (C)AP includes the auditory mechanisms that underlie the following abilities or skills:*

- *sound localization and lateralization;*
- *auditory discrimination;*
- *auditory pattern recognition;*
- *temporal aspects of audition, including temporal integration, temporal discrimination (e.g., temporal gap detection), temporal ordering, and temporal masking;*
- *auditory performance in competing acoustic signals (including dichotic listening);*

- *and auditory performance with degraded acoustic signals (ASHA, 1996; Bellis, 2003; Chermak & Musiek, 1997).*

*(Central) Auditory Processing Disorder [(C)APD] refers to difficulties in the perceptual processing of auditory information in the central nervous system (CNS) as demonstrated by poor performance in one or more of the above skills.*

## How Common is Auditory Processing Disorder?

Approximately 2-3% of school aged children have APD.

## What Causes APD?

In normal development, (C)AP skills develop at different rates until the age of approximately 7 years, at which time most children have similar abilities. Some (C)APD skills continue to develop until late adolescence.

With individuals with APD however, it is believed that there is a problem occurring in the brain or along the auditory pathways to the brain. It can be inherited, or acquired (e.g. by problems at birth, ear infections, brain injury, or environmental factors).

## Signs and Symptoms of APD

Symptoms of APD can vary, depending on the type of disorder. It is important to note that APD denotes issues with the auditory system alone – a child may have auditory processing difficulties as a result of other, more global or cognitive issues, but this is not considered a “true” or primary APD.

### Main Symptoms

- May have a history of chronic ear infections.
- May have had speech or language "delays".
- Needs instructions to be repeated.
- Can appear not to hear in noise.
- Difficulty understanding what is heard when there is background noise (more than one person speaking, or other sound distractions).
- Troubles learning and/or paying attention, especially in noisy classrooms and homes.
- Difficulty understanding verbal directions; the more complex the instructions, the more difficulty.
- Mishearing words, confusing similar sounding words.
- Difficulty with the phonics approach to reading.
- Poor speller.
- Difficulty with word problems in math
- Speaks in a monotone, or with reduced inflection.
- Difficulty understanding the lyrics to music.
- Unusually forgetful of routine information.
- Needs extra time to process what is being said.
- On psychological testing, verbal IQ score is often inferior to performance IQ score

### Emotional / Behavioural Symptoms

- Can appear to ignore someone speaking to him, especially in noise, or when involved in another activity
- Less focused, more distracted in noisy places
- Unusually bothered by loud or sudden noises
- Upset by noisy environments
- Behaviour improves in quiet settings
- Overly forgetful of routines, memorized information

- Confusion, hurt feelings from social situations if tending to take words literally, or misunderstanding intent of message
- May appear insensitive to tone of voice, or over react to perceived intent
- **May be sullen or withdrawn**

## If You Suspect APD

The diagnosis of APD is ideally done through a team of professionals, though this may not always be possible depending on the resources available in a community. The multi-disciplinary team should ideally include an audiologist, a psychiatrist and/or a psychologist, a speech-language pathologist, the teachers, and the parents.

**Audiologist:** The **audiologist** will start by looking for excessive wax, ear infections, or hearing loss, and will refer to the family physician or an otolaryngologist for treatment where indicated. The audiologist will head the investigation of, and determine the need for APD evaluation by gathering information from the other professionals on the team.

**Actual testing for APD is done by the audiologist.** Using special equipment in a sound proof room, the audiologist will test the ability to hear sounds under various conditions. For example, how one hears speech in background noise, how one deals with distorted or rapid speech, whether one can focus on one message in one ear while ignoring a different message in the other ear. These tests simulate the stress on the child's auditory system during daily listening activities. This helps discover the areas in which your child is having problems. Children under the age of seven cannot be evaluated using these tests, because their brains (including language and auditory processing) are still developing.

**Psychologist:** Psychologists can administer and interpret assessments for cognitive and educational capacities. These assessments will also rule out conditions that may either look like APD, or cause APD-like symptoms. Some of the tests done may point to an auditory processing disorder.

**Speech-language pathologist (SLP):** SLPs are uniquely qualified in the assessment of receptive and expressive language abilities. The question to answer is if the child is capable of understanding that which he hears. Some of the tests done by the speech-language pathologist also may identify areas of auditory abilities.

Information from **teachers and parents** is important to identify listening behaviours, learning behaviours, and social skills, medical history, and developmental milestones.

## APD and Other Conditions

APD can be seen on its own, but often it can be seen along with other conditions, such as:

- **Non-verbal disability:** research shows that it can be more frequent in children who have a diagnosis of non-verbal learning disability (Keller et al., 2006).
- **Attention deficit hyperactivity disorder:** although there was confusion in the past, it is now widely accepted that ADHD and APDs are separate conditions, each of which may occur on their own, as well as together. Figuring out what is ADHD and what is APD can be challenging due to the similarities in symptoms between them. Nonetheless, there are some predominant behaviors that may help distinguish between the two (Chermak et al., 1999).

### Behaviors seen with Attention Deficit Hyperactivity Disorder vs. Auditory Processing Disorders in Frequency of Occurrence

ADHD	APDs
1. Inattentive	1. Difficulty hearing in background noise
2. Distracted	2. Difficulty following oral instructions
3. Hyperactive	3. Poor listening skills

4. Fidgety/restless	4. Academic difficulties
5. Hasty/impulsive	5. Poor auditory association skills
6. Interrupts/intrudes	6. Distracted
7. Inattentive	

\*From Auditory Processing Disorders, from the Minnesota Department of Education, 2003.

## If Your Child Has APD

After review of your child's test results in all the appropriate domains, the audiologist will determine what type of auditory processing disorder fits your child's profile.

The types are:

- Primary auditory processing disorders
  - Weakness is in the auditory system
    - Auditory Decoding Deficit, which results from issues with the primary auditory cortex of the left cerebral hemisphere;
    - Prosodic Deficit, which primarily stems from functional difficulties of the right cerebral hemisphere,
    - Integration Deficit, which arises from inefficient communication between the two cerebral hemispheres in language processing.
- Secondary disorders.
  - Difficulties in language or cognition, specifically
    - Associative Deficit (previously known as "childhood aphasia",
    - Output-Organization Deficit, which is demonstrated by difficulties in planning responses to auditory information in an organized manner.

It is important for the audiologist to identify the specific type of auditory processing disorder, as treatment and recommendations differ among the subtypes. For example, FM systems are often thought of as essential for a child with APD. But if that child has a Prosodic Deficit, it will be of little use, and should not always be recommended.

## Suggestions For the Child With APD

### Do's

- **Environmental modifications**, i.e. Change the space where the child is listening.
  - **Make the classroom as quiet as possible**, especially while instruction is taking place -- this benefits the teacher(s) as well.
  - **Amplify the teacher's voice**. Sound amplification systems consist of the teacher wearing a microphone, with his/her voice broadcasted over speakers in the classroom. By amplifying the teacher's voice, it makes it easier for the child with APD to hear the teacher, and not be overwhelmed by other background noise.

Research suggests that sound amplification systems in classrooms may benefit **all** children, not only those with central auditory processing disorder. Young children cannot hear one of every six words the teacher says, due to distractions such as other children talking (due in part to interactive learning approaches that require more participation and group work), computers, the hum of lights, as well as out-of-class distractions.

The Canadian Association of Speech-Language Pathologists and Audiologists recommended in Oct 2007 that

- All Canadian teachers from kindergarten to Grade 3 should wear microphones,
  - Classrooms should be equipped with surround-sound systems to give every pupil a "front-row seat" when it comes to hearing
- **Remediation activities:** Direct intervention or therapy, usually provided by a speech-language pathologist (SLP) to improve auditory processing abilities;
  - **Compensatory strategies.**

### Don'ts

- Don't simply use a big list of preprinted suggestions for APD. Ideally speak to a professional knowledgeable about APD to individualize suggestions for your situation. Not all suggestions are appropriate for all types of APD, and some that are recommended for one type could be unhelpful or even detrimental for another, not to mention a burden for the teacher, and a lengthy addition to an Individualized Education Program (IEP).

## For More Information

Ontario Association of Speech & Language Pathologists: [www.osla.on.ca](http://www.osla.on.ca)

American Academy of Audiology : [www.audiology.org](http://www.audiology.org)

American Speech Language Hearing Association: [www.asha.org](http://www.asha.org)

The Minnesota Department of Education has an excellent downloadable handout at <http://education.state.mn.us/mdeprod/groups/SpecialEd/documents/Instruction/001567.pdf>

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## About this Document

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