Central Auditory Processing

By Helen Dudeney MEd, COGE

What is central auditory processing

Central auditory processing occurs "when the ears detect sound,(and) the auditory stimulus travels through the structures of the ears, or the peripheral auditory system, to the central auditory nervous system that extends from the brain stem to the temporal lobes of the cerebral cortex. The auditory stimulus travels along the neural pathways where it is "processed," allowing the listener to determine the direction from which the sound comes, identify the type of sound, separate the sound from background noise, and interpret the sound. The listener builds upon what is heard by storing, retrieving, or clarifying the auditory information to make it functionally useful." (Ciocci 2002,p2)

What is central auditory processing disorder

According to American Speech-Language-Hearing Association (ASHA) 1996 "Auditory processing disorder is a sensory processing deficit that commonly impacts listening, spoken language comprehension, and learning"

It is estimated that two to three percent of children have central auditory processing disorders and that there is a 2:1 ratio of boys to girls. This greater incidence of boys to girls is perhaps further explained or supported by recent research work by neurophysiologists LePage and Murray at the Australian National Acoustic Laboratories looking at auditory capacity using otoacoustic emission tests, which measures how quickly the ear responds to streams of sounds such as speech. The findings of the initial study consisting of 3000 clinic-referred people ranging in age from 2 – 80, indicated that there is notable decline in auditory processing ability with age in both females and males. In addition to this the data shows that after the age of four years male's ability to process auditory 'streams' of sounds such as speech is significantly less than females (Rowe 2004).

LePage (2002) states:

"The overwhelming fact …. is that from about the first decade of life the ears of boys are effectively older than the ears of girls. They process sounds more slowly and provide less information to the brain to be analysed. … We are saying that , given our findings, it is not reasonable to expect that boys, on average, will absorb class teaching material as readily as girls" (Cited in Commonwealth_of_Australia 2002p. 104-105)

Central auditory processing disorder does not relate to the ability to hear but rather an inability or decreased ability to use auditory information.

"The sensory system (in this case the ear) that brings speech into the body is working properly but the parts of the brain that analyse and interpret the sensory information are not."("Audiology & Speech pathology Clinic 1996, p1) Keith 1995 describes auditory processing disorder as an impairment that means that when information is presented auditorily the individual may not be able to attend to, discriminate, remember, or comprehend the information accurately despite the fact that they have average to above average intelligence and no hearing problems (Ciocci 2002).

They "can typically hear information but they have difficulty attending to, storing, locating, retrieving, and /or clarifying that information to make it useful for academic and social purposes"(Katz & Wilde, 1994 quoted in (Ciocci 2002,p 1).

What causes Central Auditory Processing disorders

It is not known exactly why the problem develops however several possible causes have been identified these include:

Conductive hearing blockage during the first 5 years of life. This can be caused by wax blockages of the outer ear, multiple middle ear infections or Otitis Media, glue ear or blockages of the Eustachian tube at top by inflamed adenoids or stuffed noses and /or at the bottom by swollen tonsils. Also children who have allergies, respiratory illness, foetal alcohol exposure, deficiency in certain minerals, vitamins and fatty acids, or suffered birth trauma may experience such blockages(Moncrieff) (Pittelkow 2001).

"By age 3, over 70 percent of American children have had respiratory illnesses resulting in at least one bout of otitis media; 33 percent have had 3 or more bouts (Daly, Hunter, & Giebink, 1999) Although antibiotics eliminate the bacteria responsible for otitis media, they do no reduce fluid build up in the middle ear, which causes mild to moderate hearing loss that can last for weeks or months.

The incidence otitis media is greatest between 6 months and 3 years, when children are first acquiring language. Frequent and prolonged infections predict delayed language progress, reduced task persistence, social isolation in early childhood, and poorer academic performance after school entry (Rvachew et al., 1999;Roberts et al., 2000; Vernon-Feagans, manlovee, & Volling, 1996)" (Berk 2003 p149)

During the time when the conductive hearing is blocked, it is often the high frequencies that are lost. As high frequencies are processed in the left hemisphere this blockage means that the left hemespheric stimulation normally caused by high frequencies is reduced in resulting in less development.

"The right hemisphere seems to 'get' the low frequency sounds, and the left hemisphere also seems to become more highly specialized for handling the high auditory frequencies. (Ornstein, 1997.pp153-154) the high frequencies are responsible for the development of sequencing and other language functions. (Silverman 2002p 33)

Environmental factors including exposure to cigarette smoke, early introduction to solids.

Stress, yeast infections, and TMJ disorders – the joint that hinges the lower jaw to the skull.

Blocked nerves at the first cervical vertebrae.

Post head injury, hyperacusis – every day sounds are over amplified and intrusive.

History of anti-depressant medication like Prozac, which slows aural processing.

Exposure to neurotoxins such as lead and carbon monoxide. (Pittelkow 2001)

How is it identified

Identification may not always be easy and obvious. Kruger et al 2001 found that central auditory processing disorder often co existed with one or more other learning problems including language disorders, sensory integration dysfunction and learning disabilities(Kruger and Kruger 2001). In addition to this if the disorder co exists with intellectual giftedness it may go undetected and the child may appear to have neither a disability nor advanced cognitive abilities. Instead they may appear to be of average ability. This phenomenon therefore suggests that a multidisciplinary approach to identification is important.
Through the use of behaviour/performance checklists parents and teachers can provide important information about the child's auditory behaviours. Data from both the home and school environment are important. Audiologists and speech pathologists can conduct a variety of specific tests looking at hearing, processing and receptive-expressive language usage. Psychologists and educators can provide information on both the child's intellectual potential and the academic performance, identifying both their strengths and weaknesses. Occupational therapists identifying the involvement of the sensory systems, auditory, visual, somato-sensory in the behaviours displayed by the child can also identify central auditory processing disorders.(Kruger and Kruger 2001)

The audiologist will test both the peripheral auditory system – to ensure the child doesn't have any hearing loss, and the central auditory system to assess how the child handles auditory input in different environmental situations.

What problems are associated with it

CAPD can impact on a person's performance and interactions in both academic and social situations. If the brain isn't receiving auditory messages efficiently then it will make responding to them difficult.
The more challenging the listening situation the greater the difficulties experienced by children with auditory processing disorders. This can include places with noisy backgrounds or poor acoustic environments such as parties, shopping centres, noisy classrooms.
The distance the listener is from the speaker, such as lectures, classrooms, playgrounds.
The speed or accent of the speaker.
Some of the problems include difficulty sequencing speech sounds, difficulty understanding speech with background noise and problems with timing.

Keith 1995 provides some examples of the behaviours that may be seen in children with this disorder. As with all checklists not all those with the problems will display the same behaviours and they may be evident to a lessor of greater extent in different children.

Inconsistent response to verbal stimulus – sometimes referred to as selective deafness
Frequently asking for information to be repeated – What? Huh? What did you say?
Difficulty listening and paying attention if the environment is noisy or there are distracting sounds (often these sounds are not even apparent to others in the environment)

Misunderstanding what is said – perhaps needing to guess to fill in the gaps that have been missed
Poor short-term auditory memory and difficulty following a long series of instructions
Difficulty in identifying the direction from which a sound is coming.

What strategies can be used to assist people with CAPD

Be supportive and show understanding
Modify the environment to reduce background noise such as fans, overhead projectors, air conditioners, computer hard drives, traffic, hallways, noisy furniture.
Seat student in close proximity to teacher, an in a place with minimum distractions
Allow the student to tape record verbal information

Experiment – keep a log of what works and doesn't work
Slow down - presenting things too quickly doesn't work.
Modify speech patterns and use simpler constructions
- Be specific – use concrete instructions
- Be brief – long lists of instructions are confusing and easily lead to anxiety when they can't be recalled
- Allow more time for comprehension, processing and responding

Get the student's attention and maintain visual contact while speaking to them
Use visuals to support auditory information
Check whether new material or information is understood. Review it where necessary, and use visual or gestures to assist with recall.
Develop strategies that allow for success and help the child become responsible for using these strategies and asking for assistance when required.
Develop memory techniques – visualizing, verbal rehearsal, mnemonics
Use organizational aids – checklists, mind maps ,
In the case of blocked nerves chiropractors can successfully treat otitis media patients. (Pittelkow 2001)
Auditory retraining such as Tomatis and Somonas Sound Therapy have seen growing acceptance in recent years, due to their clinical successes. This intervention involves the use of music to exercise and strengthen the auditory pathways in a way that mimics the natural development that didn't occur during the child's early year.

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