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for Speech Disorders**
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Childhood Apraxia of Speech (CAS)

Fact Sheet – Speech Disorders

Childhood Apraxia of Speech (CAS) is detectable in early childhood but can continue into adulthood.

Children with CAS have problems saying sounds, syllables, and words accurately and with the correct rhythm.

Although a child with CAS knows what they want to say, their brain struggles to correctly move their lips, jaw, and tongue to speak clearly and be understood.

Learning to speak is like learning to perform any skilled movement. Just like playing the piano or knitting, at first you must concentrate on all the steps then with practice this process becomes automatic. Most children easily memorise the steps involved in speaking until it becomes automatic, but children with CAS must continually re-learn how to produce a word or phrase by asking themselves:

- *Which sounds do I need?*
- *What order do the sounds come in?*
- *How do I move my lips, tongue etc. to make those sounds?*
- *Which sounds or words do I stress?*

Children with CAS can become frustrated that they cannot communicate clearly or be understood. Families may also find it hard to understand why



speech is so difficult for their child when it is often automatic or 'easy' for others.

We don't know exactly how many children have CAS but we know it is rare. Only 1-2 children per 1000 enrolled in speech therapy are estimated to have it. CAS is the term most used today in Australia, North America, and Europe but it is also known as Developmental Verbal Dyspraxia (typically in the United Kingdom), Apraxia of Speech or Verbal Dyspraxia.

What are the signs of CAS?

There are many different signs of CAS and not all children will have the same ones. The signs also change as a child gets older and as the severity of the condition changes.



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Young children with CAS may:

- have difficulty feeding,
- coo, babble or play with sounds less than other children,
- use a limited range of sounds when they do begin to talk,
- find it easier to understand others than talk themselves,
- visibly struggle to talk; groping or searching for sounds
- be very hard to understand even to people close to them (i.e., family members).

Older children with CAS may:

- struggle with longer words or phrases,
- drop or add sounds to words or replace sounds with unexpected sounds (e.g., say 'copa' for 'helicopter' OR 'umbaneda' for 'umbrella')
- say the same word in a number of different ways (e.g., say 'caterpila', 'catiperla', 'cratapila' for 'caterpillar')
- stress the wrong part of a word or sentence making their speech sound 'robotic' or 'accented'.

Children with CAS are more likely to have language and literacy (reading, spelling) difficulties also. Sometimes children with CAS will also have difficulty with small muscle movements called fine motor skills (e.g., handwriting, cutting) or large muscle movements called gross motor skills (e.g., running). Some children also have a diagnosis of motor dyspraxia or developmental co-ordination disorder (DCD). Some children also have more generalised learning difficulties such as intellectual disability, or other neurodevelopmental conditions such as autism, attention deficit hyperactivity disorder (ADHD), and epilepsy.

What causes CAS?

Unfortunately, we often do not know what causes CAS. We know that something interferes with messages getting from the brain to the mouth

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muscles, but we do not always know why.

CAS may be caused by genetic changes. Some gene changes we can identify but others which we don't know yet. There have been over 30 single genes or 'monogenic' conditions shown to cause CAS (e.g., *FOXP2*-related speech and language disorder; *CDK13*-related disorder; *SETBP1*-haploinsufficiency disorder (<https://www.geneticsofspeech.org.au>).

There are also chromosomal disruptions that can involve more than one gene which are also associated with CAS (e.g., 16p11.2 deletion; Koolen-de Vries syndrome). Children with these conditions usually have other health, development, or cognitive difficulties. In a small number of cases, CAS is caused by a problem breaking down the simple sugar galactose (this condition is typically detected in the first months of life). In a small number of cases, CAS is caused by damage to the brain from an injury or stroke.

How is CAS diagnosed?

It is important to see a speech pathologist (SP) (also known as a speech and language pathologist, SLP, speech therapist) to confirm a diagnosis of CAS. This is because CAS is a complex condition with a number of signs and associated conditions. SPs are specially trained to recognise CAS. In Australia, a GP, teacher, or other health professionals may refer you to an SP.

To diagnose CAS, an SP will get your child to do a number of 'talking tests'. Speech and language in toddlers naturally varies a lot. Before 2-3 years of age, children with other types of speech and language conditions may share some early signs of CAS (e.g., slow to talk, few first words). This does not mean they all have CAS. CAS is rare, so if your SP is unsure about your child's diagnosis, it might be best to see an SP with experience diagnosing CAS.

How is CAS treated?

Early therapy with an SP can improve your child's ability to communicate and reduce frustration. Like



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with any skilled movement, practice or therapy is usually most successful when it happens several times a week. While some children overcome CAS with therapy, others find therapy improves their ability to communicate but does not change the concentration CAS demands or the tiredness it can cause.

The type of therapy will depend on:

- the child's symptoms,
- their age,
- the severity of their condition,
- any other health or development problems they have.

Existing treatments have varying levels of efficacy for treating CAS, including:

- Nuffield Dyspraxia Program (NDP3)
- Rapid Syllable Transition Treatment (ReST)
- Dynamic Temporal and Tactile Cueing (DTTC)
- Prompts for Restructuring Oral Muscular Phonetic Targets (PROMPT)

You should ask your SP about how effective these programs (or the ones they are recommending) will be for your child given their age and symptoms. Therapy may also include activities designed to strengthen language and skills, given children with CAS have a greater risk of problems with these skills.

CAS is a difficulty with planning movements for speech. There is no strong evidence to support the use of non-speech oral motor exercises alone (e.g., pursing, blowing, lip massage etc.) as an effective treatment for speech sound disorders.

Children who are experiencing great difficulty with the production of verbal speech may also benefit from multi-modal forms of communication (e.g., sign language or communication devices). These are also known as augmentative or alternative communication (AAC) options. Many parents are concerned that use of AAC may reduce their child's verbal speech and language development. However, evidence suggests that providing children with more/easier communication options can reduce frustration and will encourage language and speech learning. For example, being able to produce sentences with a digital device is very powerful for a child who has difficulty producing one syllable words and helps support learning of sentence structure and grammar.

Further to speech and language focused therapies, your child may also benefit from seeing:

- **Psychologists/counsellors**, if they are struggling at school with learning or social relationships
- **Occupational therapists/physiotherapists**, if they have fine/gross movement challenges
- **Neuropsychologists**, if they have trouble with attention, memory, or other cognitive areas

Things to remember:

- Children with CAS have trouble correctly moving their mouth muscles so they can speak clearly and be understood.
- CAS begins in childhood but often remains throughout adulthood.
- Genetic causes are frequently being identified for CAS (see: <https://www.geneticsofspeech.org.au>)
- Ask your GP whether they feel genetic testing could be relevant for your child. In Australia, we have a Genetics of Speech clinic where you will see an SP and clinical geneticist to see if there may be a genetic cause for your child's CAS. (<https://www.geneticsofspeech.org.au/research/speech-apraxia-and-genetics-clinic/>)
- It is beneficial to seek help early and get the right treatment and support for your child's symptoms and age.



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