What Everyone Ought to Know about Childhood Apraxia of Speech
Part 1 - Assessment

Overview of the day
- Part 1
  - Understanding CAS
  - Recognizing breakdowns in speech movement sequences
  - Assessing CAS
- Part 2
  - Treating CAS – therapy considerations based on the principles of motor learning
  - ASHA documents
  - Before and after videos – case examples

PART 1
ASSESSMENT

Understanding CAS
- Speech Production
- Motor Speech Disorders
- CAS - Breakdown at the level of motor planning and programming
- Definition
- Characteristics
- Speech disorder comparisons:
  - CAS vs. phonological disorder vs. dysarthria

Motor speech disorders
Breakdowns in motor speech production
Cognition:
  Idea
Language:
  Word retrieval
  Phonological mapping
  Syntactic framing
Motor Speech Production:
  Planning: Apraxia
  Programming: Apraxia and Stuttering
  Execution: Dysarthria

Breakdown
- Praxis = “the performance of an action” (Millholen, 2007)
- Childhood Apraxia of Speech = breakdown at motor planning and programming level of speech production
- If breakdown occurs at other levels, it is not called CAS
Definition

*Childhood apraxia of speech (CAS) is a neurological childhood (pediatric) speech sound disorder in which the precision and consistency of movements underlying speech are impaired in the absence of neuromuscular deficits (e.g., abnormal reflexes, abnormal tone). CAS may occur as a result of known neurological impairment, in association with complex neurobehavioral disorders of known or unknown origin, or as an idiopathic neurogenic speech sound disorder. The core impairment in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody.* (ASHA 2007b)

Think about skilled movements

- Walking
- Figure skating
- Piano playing
- Tennis playing
- Sucking
- Speaking

Speech motor vs. oral motor

Oral motor control for non-speech movement separate from oral motor control for speech movements
- Speech requires finer levels of coordination (Green et al., 2000) but lower levels of strength than are available for other oral-motor activities (Forrest, 2002).
- Motor control for feeding is separate from motor control for vocalizations early in infancy (Moore & Rusk, 1996), as is motor control for speech breathing vs. breathing at rest (Moore et al. 2001).
- Influence of movement patterns for feeding is likely, if anything to be negative rather than positive, as feeding patterns involve the lips and the jaw moving together in highly rhythmic, stereotyped movements. Speech, on the other hand, requires the child to overcome the stereotyped interdependent, inflexible patterns of sucking and produce varieties of movements to utter syllables with varied prosodic patterns (ASHA, 2007a).

1st thing you ought to know

- CAS is a speech movement disorder

Jonah speech characteristics

- Age 3:
  - consonants: b, m, w
  - Vowels: uh
  - Syllable shapes: CV

Recognizing breakdowns in movement sequences for speech

- What are we looking for?
- How do we identify the characteristics???
  - CAS definition: The core impairment in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody...
Other movement breakdowns

- Walking
- Figure skating
- Piano playing
- Tennis playing

Core speech characteristics

Four key features that are consistent with a deficit in motor planning and programming for speech

- Inconsistent errors on consonants and vowels in repeated productions of syllables or words
- Vowel errors
- Lengthened and disrupted coarticulatory transitions between sounds and syllables
- Inappropriate prosody, especially in the realization of lexical or phrasal stress

Core speech characteristics, cont.

Four key features that are consistent with a deficit in motor planning and programming for speech

- Vowel errors (Davis, et al., 2005)
  - In children with CAS, vowels were inaccurate (15-39%) even when they had acquired a relatively complete vowel inventory (NORM is 8% at 2 years, and 7% at 3 years)
  - CAS children showed no consistent pattern of errors
  - CAS children did NOT use most stable vowel as substitute for errored vowels – whereas phonological children DID
  - CAS children had decreased rhotic vowels compared to norms

EXAMPLE – A child may say “buh” for “hop” or may distort a vowel so that it does not sound like an English vowel.

Core speech characteristics, cont.

Four key features that are consistent with a deficit in motor planning and programming for speech

- Lengthened and disrupted coarticulatory transitions between sounds and syllables
  
  A child with CAS produces a word, there may be lengthy pauses or breaks between the sounds or syllables within the word. This may be due to difficulty coordinating the motor movement of the articulators from one sound to the next. Or, the child may have a problem coordinating “voicing”, such as going from a voiceless consonant to a voiced vowel (learning to play piano – long pauses while you figure out the next note)

EXAMPLE: A child may be trying to say the word “top”, and may effortfully separate each sound, resulting in a production that sounds like “T---a---p” – Or, a child may pause between sounds, syllables and sounds within a word. Example: “cow---or---cow” – instead of “cow-ow”

Core speech characteristics, cont.

Four key features that are consistent with a deficit in motor planning and programming for speech

- Inappropriate prosody, especially in the realization of lexical or phrasal stress
  The melody of the speech pattern is affected, lacking intonation and appropriate stress patterns. A child’s speech may lack expression and sound robotic (learning to play piano – notes separated from each other at first – not fluid – not melodic – until the motor plan is learned – then it bonds)

EXAMPLE: When asked, “Who’s toy is this?” the child might say “It’s my toy” but not emphasize the word “my” as is expected when a child is emphatic about indicating possession. Or, a child may separate and place equal stress on syllables within a word. This can result in “lass-tor-gal” instead of “last-tor-gal” with a staccato pattern of speech (i.e., TO-MA-TO” instead of “toMA-to”.

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Other speech characteristics

- Increased errors in longer or more complex syllable and word shapes (especially omissions, and in word initial positions)
- groping
- unusual errors that “defy process analysis”
- persistent or frequent regression, differences in performance of automatic (over learned) vs. volitional (spontaneous or elicited) activities, with volitional more affected
- Inconsistent hyper-nasality

(ASHA, 2007a, Sealey & Giddens, 2010)

Speech characteristics seen in CAS, and also in other speech sound disorders

- errors in the ordering of sounds (metathesis and migration), syllables, morphemes or even words
- slow development of speech
- reduced phonetic or phonemic inventories
- multiple speech sound errors
- reduced percentage of consonants correct
- Unintelligibility

(ASHA, 2007a)

Associated features

<table>
<thead>
<tr>
<th>Language &amp; Literacy</th>
<th>Speech Perception</th>
<th>Phonological</th>
<th>Non-speech motor</th>
</tr>
</thead>
</table>
| Significant delays  | Deficits in auditory discrimination | Increase self-awareness of tone, intonation limits | Speech awareness or Garrison, 
| In quality of 
| expression language | | | 
| Difficulty in initial sound or word production | Deficits in auditory discrimination | Core apraxia, issues in rapid and required rate of oral movements |
| Deficits in articulation and sound blending | Deficits in auditory memory | Mid-rate inarticulate pronunciation |
| Attention for phonological awareness deficits | | Childhood apraxia, phonological awareness, articulation |

Speech disorder comparisons:
Comparison of CAS vs. dysarthria vs. severe phonological disorder

Compiled by members of the Advisory Board of the Childhood Apraxia of Speech Association (CASANA)

Located online at apraxia-kids.org:
http://www.apraxia-kids.org/site/c.cW5BPhkEBE/h.8R6D1/scontent/a蓉content.as?l=a84f1

(CASANA, 2004)

Speech Disorder Comparisons

- Apraxia
  - Inconsistent errors
  - No swallowing issues

- Phonological
  - Predictable pattern of errors
  - No swallowing issues

- Dysarthria
  - Generally consistent errors
  - Weakness of musculature

- No weakness

(CASANA, 2004)

Recognizing Breakdowns Practice

Student #1:
Consistency of errors - Vowels – Coarticulatory transitions – What else?
Recognizing Breakdowns Practice

Student #2:
Consistency -
Coarticulation -
Stimulable -
What else -

Recognizing Breakdowns Practice

Speech disorders can coexist – i.e. primary dysarthria with secondary apraxia

How to assess for CAS

What is the goal?

- Presence of the disorder – difficulty with movement sequences for speech
- Presence of other speech/language disorders – differentially diagnose
- Severity of the disorder
- Relative contribution of the disorder to the child’s overall communication disorder
- Prognosis
- Example: Severe CAS and mild phonological disorder, with CAS being the primary contributing factor to Jimmy’s speech production disorder. Prognosis: good.

Assessment cheat sheet - skills

Looking for breakdowns in movement sequences for speech & other assoc. features:
- automatic vs. volitional control
- simple vs. more complex speaking
- consistency of productions on repetitions of same word
- prosody (stress)
- phonetic inventory
- vowel production
- language skills
- associated features
- functional communication ability/needs
- stimulability to levels of cuing

Assessment cheat sheet - tasks

Converging evidence from a variety of assessments and observations:
- Spontaneous speech/language sample during natural play
- Elicited speech sample during natural play
- Imitation tasks
- Oral apraxia assessment
- Oral motor exam
- Language assessment – exp. and rec.
- Articulation test
- Augmentative communication assessment

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Problem
- Imitation tasks are core to identifying CAS
- No valid or reliable standardized assessment sensitive to CAS (McCauley & Strand, 2008)

Solution
- Build your own motor speech assessment
  - Obtain descriptive and quantifiable information on errors as they relate to CAS

Build your own
Imitation Tasks
- List of words organized by syllable shape - beginning with simple and moving to complex
  - representative sample of all vowels and diphthongs
  - representative sample of all developmentally appropriate consonants
  - include some strings of words and phrases that get progressively longer, building on each other

Have child say words in imitation and listen for:
- Vowels
- Consistency from trial to trial
- Prosody
- Coarticulatory transitions between sounds and syllables

Mock Assessment
Imitation Tasks
- Word lists organized by complexity of syllable shape (VC, CV, CVC, CVCV, etc...)
  - Example:
    VC - up, eat...
    CV - two, me....
    CVC - home, dog....
    CVCV - baby, hippo....
    ETC...

Strings of progressively longer words and phrases building on each other:
- Example:
  no, no mom, no mommy
  hi, hi dad, hi daddy
  banana, eat a banana, I eat a banana

Mock Assessment: imitation tasks
#1
NO = nuh
NO MOM = on muh
NO MOMMY = ub-nuh

Mock Assessment: imitation tasks
#1
UP = up
EAT = it
TWO = tuh
ME = mo-uh
HOME = muh-muh-o
DOG = guh-n
BABY = uh-puh
HIPPO = puh-pum
Mock Assessment: imitation tasks

#1
TWO = two
TWO = tuh
TWO = oot

Mock Assessment: imitation tasks

#1
BABY = buh-boouh

Mock Assessment: imitation tasks

#1:
Characteristics of…

Mock Assessment: imitation tasks

#2
NO = no
NO MOM = no moh
NO MOMMY = no moh

Mock Assessment: imitation tasks

#2
UP = uh
EAT = ee
TWO = koo
ME = me
HOME = ho
DOG = goh
BABY = bay
HIPPO = hih

Mock Assessment: imitation tasks

#2
TWO = koo
TWO = koo
TWO = koo
Mock Assessment: imitation tasks

#2
BABY = bay

Mock Assessment: imitation tasks

Characteristics of…

Mock Assessment: imitation tasks

• Videos of Brandon
• Listen for:
  - Consistent or inconsistent errors?
  - Vowels?
  - Prosody – stress?
  - Coarticulated/segmented?
  - More difficulty with increasingly longer utterances?

Mock Assessment: imitation tasks

• Video 1 = Brandon imitation task
  - VC
  - CV
  - CVCV 1
  - CVCV 2
• Video 2 = Brandon imitation task
  - Increasingly longer utterances

Mock Assessment: imitation tasks

Question?

• Consistency?
• Vowel errors?
• Prosody?
• Coarticulated/segmented?
• Increasingly longer utterances?

• Can I determine the presence of motor planning and programming difficulties by just doing a standardized articulation and language test?
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Jonah – 4 years old

- Dog/dog
- Laugh/laugh
- Baa (sheep sound)
- Cow/cow
- No/no
- Dug/dog
- Baaaa (sheep sound)
- Sheep/sheep

Age 3:
- Consonants: b, m, w
- Vowels: uh
- Syllable shapes: CV

Age 4 (2 minute sample):
- Consonants: b, m, w, p, d, g, l, n, s
- Vowels: short a, short o, long o, e, e
- Syllable shapes: CV, CVC

Look beyond test scores!

- GFTA2 not able to determine degree of motor speech involvement (Burns, 2011)
- Standardized assessments for assessing speech and nonspeech oral motor function in children are deficient – lacking in reliability and validity (McCaughey & Strand, 2008)
- Use of the data from a single standardized test of articulation or phonology would not be sufficient for completely inventorying a child’s consonant and vowel production and selecting targets for therapy (Eisenberg et al 2010)

2nd thing you ought to know

- You might not be able to observe difficulties in sequencing movement gestures for speech if you JUST use standardized articulation and language tests

Summary Part 1

- We understand CAS = speech movement disorder
- We understand that the part of the brain that controls movements for speech:
  1) where in space
  2) when to move
  3) how fast to move is disrupted.

Summary Part 1, cont.

- We understand what the breakdowns look like:
  - Inconsistencies
  - Vowel errors
  - Disrupted transitions between sounds
  - Prosody errors
- We figured out what tasks we needed for an assessment

References


References


Baltimore: Williams and Wilkins.

Perspectives on Neurophysiology and Neurogenic Speech and Language Disorders.


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References


