Childhood Apraxia of Speech (CAS): Assessment through Intervention

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Disclosures

- Financial – Meredith White is the owner and lead speech pathologist of a private practice clinic in Atlanta, GA and receives no financial compensation from GSHA.
- Nonfinancial – Meredith is a member of GSHA and receives no financial compensation from GSHA.
- Recognized by the Childhood Apraxia of Speech Association of North America (CASANA) for advanced training and expertise. Meredith receives no financial compensation from CASANA.

What is Childhood Apraxia of Speech (CAS)?

- **Childhood apraxia of speech** (CAS) is a neurological **childhood 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).
- Childhood Apraxia of Speech Association of North America (CASANA): apraxia-kids.org

Introduction

- Assessment and treatment of Childhood Apraxia of Speech (CAS) can be a difficult task for a number of reasons:
  - Comorbid Dx: Language Impairment, Autism, T21
  - Confusion and lack of formal dynamic assessment process for differential diagnosis
  - Confusion regarding what exactly is CAS
  - Non-speaking kids
  - Lack of trust from unsuccessful therapy in the past

What is Apraxia?

- What do we call it?
  - Childhood Apraxia of Speech?
  - Dysathria?
  - Verbal Dyspraxia?
  - Oral Dyspraxia?
  - Phonological Processes?

ASHA (2007) defines CAS as having the following three essential elements:

- Inconsistent errors on consonants and vowels in repeated productions of syllables and words.
- Lengthened co-articulatory transitions between sounds and syllables (choppiness, intrusions, lack of fluency/stuttering)
- Inappropriate prosody, especially in the realization of lexical or phrasal stress.

CAS Articulatory Characteristics

- **Multiple Speech Sound Errors**
  1. Omissions (most common)
  2. Substitutions – often hear pre-vocalic voicing errors (bat/pat)
  3. Distortions (can be difficult to transcribe)
  4. Additions (e.g., balue for blue)
  5. Errors related to the complexity of articulatory adjustment.
     1. Consonant hierarchy: clusters>fricatives>stops>nasals
     2. Vowel hierarchy: diphthongs>monophthongs
  6. *Independent* phonetic inventory is larger than *relational* inventory
  7. Presence of vowel errors

Prevalence:

- CASANA: Research is lacking in providing us with information regarding both incidence and prevalence figures.
- The estimates of some sources indicate that CAS is low incidence with perhaps 1 – 10 in 1000 children affected or 3 – 5 % of speech-impaired preschoolers.
- In addition, some believe that the incidence of CAS may have increased in recent years.
- However, there are no published scientific data to support this general sense of increased incidence.

Co-morbid to CAS:

- CASANA: There appears to be some consensus and research evidence that children who display these sorts of speech motor impairments also typically have problems in certain aspects of expressive and/or receptive language, even if subtle. Reportedly, “pure” apraxia of speech in children is rare. There is currently no agreement as to whether these linguistic impairments are central to the disorder or are separate issues that co-occur or are co-morbid. Some individuals have described CAS as a disorder that changes and unfolds over time.

CAS & Autism:

- The researchers assessed 30 children, ages 15 months to 5 years, seen at their developmental communication clinic.
- Their follow-up testing showed that **64 percent** of the children initially diagnosed with autism also had apraxia, and **37 percent** of the children initially diagnosed with apraxia also had autism. (Oct 2015)

Motor speech disorder

- Examination of the current literature reveals that CAS is a disorder of motor movement and like PT, should be treated as work on integrated bundles of movement.
- Schema Theory: assumes that production of rapid discrete movements involves units of action (motor programs) that are retrieved from memory and then adapted to a particular situation. A motor program is an organized set of motor commands that can be specified before movement initiation.

WHO provides a Dx of CAS?

- A SPEECH-LANGUAGE PATHOLOGIST WITH SPECIALIZED TRAINING IS THE PERSON WHO IS QUALIFIED TO PROVIDE AN APPROPRIATE DIAGNOSIS OF CHILDHOOD APRAXIA OF SPEECH.

Differential Diagnosis

- Speech Sound Disorder Classification System: *Shriber, et al, 2010*
- Speech Delay/Disorder:
  - Phonological Disorder
  - Articulation Disorder
- Motor Speech Disorder:
  - Childhood Apraxia of Speech (CAS)
  - Dysarthria (DYS)
  - Speech-Motor Impairment (SMI) MSD-NOS

Childhood Apraxia of Speech

- * Inconsistent errors on consonants and vowels
- * Lengthened/disrupted co-articulation
- * Inappropriate prosody
- * Absence of neuromuscular deficits
- Groping
- Syllable segregation
- Intrusive schwa
- Voicing errors
- Increased difficulty with longer or more phonetically complex words & phrases
- Slow rate

Childhood Dysarthria (DYS)

- Consistent errors on consonants and vowels – often sound distortions
- Equal stress
- Slow rate
- Presence of neuromuscular deficits
  - Reduced range of motion
  - Reduced strength of articulatory contacts
  - Reduced respiratory support or respiratory incoordination
  - Strained or breathy voice quality
  - Adventitious movement

Severe Phonological Disorder

- No weakness, paralysis or incoordination of speech musculature
- Chewing, swallowing and involuntary movements are typical
- Consistent errors that can be grouped into categories such as phonological processes
- Typically no disruption of rate, rhythm or stress

CAS and Co-morbidities

- Research is showing correlations with long-term speech sound production and early literacy delays.
- CAS is negatively affecting phonological development and awareness

Dynamic Assessment

- Thorough case history.
- Thorough oral-mech exam:
  - R/O Dysarthria:
  - Diadochokinesis
  - Respiration: Phonation and breath support are adequate. Straw placed 5cm below water, blew 5 seconds.
  - Maintain phonation without voice breaks
  - Symmetry of uvula during phonation, facial symmetry smile/kiss
  - Muscle Weakness; Inability to move articulators reflexively or volitionally

Dynamic Assessment

- Motor Speech Assessment
  - Dynamic Evaluation of Motor Speech Skill (DEMSS)
    - *Strand, McCauley, Weigand, Stoeckel & Baas., (2013). A motor speech assessment for children with severe speech disorders: Reliability and validity evidence, JSLHR, Vol 56., 505-520*
    - Assesses Syllable Shapes of Increasing Length
      - CV, VC, CVC, VCV, CVCV, Polysllyabic, Phrases of Increasing Length
    - Vowel Accuracy
    - Prosodic Accuracy: I want it. I WANT it. I want IT.
    - Consistency of productions
    - Cueing hierarchy/stimulus required to produce target

Dynamic Assessment

- Standardized evaluation of speech sound inventory, speech consistency, vowel consistency.
  - Diagnostic Evaluation of Articulation and Phonology (DEAP)
- Non-word Multisyllabic Repetition Test
- Dodd's Speech Consistency Test
- Speech Perception Assessment:
  - Comprehensive Test of Phonological Processing C-TOPP-2
  - Lindamood Bell Auditory Conceptualization Test LAC-3
  - Locke's Speech Perception – Production Task

Video: Dynamic Assessment V.L.

Methodologies / Big Picture/ Evidence Based Practice (EBP):

- So Many Approaches! What do I do?
- Is the Approach Evidence Based?
- Based on Principles of Motor Learning?
- Will one methodology/approach be enough input for my client to succeed?
- How do I choose my targets?
- How do I choose my goals?
- Intelligible approximations?
- Compensatory placements?

Methodologies or Tools

- Will training in one methodology provide all my clients' needs?

- Methodologies based on Principles of Motor Learning:
- Discreet Temporal and Tactile Cueing (DTTC)
- PROMPT
- Kaufman
- Speech EZ
- David Hammer
- Nuffield
- ReST

What is DTTC, aka Integral Stimulation?

- Edythe Strand CCC-SLP, PhD Mayo Clinic.
- Integral Stimulation:
  - The hierarchical intervention approach originally developed for apraxia of speech in adults and involves imitation and motor learning principles.
  - An example of an integral stimulation. Combines:
    - motor learning principles, cues and modeling to encourage speech target production.
    - The clinician facilitates speech through imitation.
    - The child's articulation is shaped through multi-modal cueing techniques (including tactile, visual, auditory and proprioceptive cues) to promote accurate movement gestures.
    - Cues are individually based on the childs' response and motivations.

Video: DTTC, Edyth Strand, PhD

PROMPT

- PROMPTS for Restructuring Oral Muscular Phonetic Targets
  Developed by Deborah Hayden, SLP.
- PROMPT is essentially a therapy tool/technique whereby the SLP provides tactile/kinesthetic input to the facial muscles of articulation to assist in the sensory-motor execution of speech.
- *Many well known SLP/CAS therapists do NOT use PROMPT.

Video: PROMPT
Deborah Hayden CCC-SLP

Kaufman:

- Developed by Nancy Kaufman, SLP.
- Builds on the principle of motor learning.
  - Assessment and therapy kit that promotes building small small motor units into bigger units of intelligible speech.
  - Focus on building intelligible approximations into longer motor units of intelligible speech.
  - Consistent with leading research on CAS.
  - Nancy Kaufman, herself uses an ABA and play model to get as many productions of motor targets as possible.

ReST:

- Developed in Australia. Tricia McCabe, PhD
- Based on Principles of Motor Learning
- Pre-practice/Practice
- High rate: 100 trials per session
- High complexity of stimuli (mulit-syllabic nonsense strings pedakuh
- Randomized practice
- Delayed Knowledge of results feedback in practice mode

ReST: Who Does it Benefit?

- Research evidence 4-12 years old
- Children with CV structured syllables with minimum 4 C and 4 V
- Children need to be able to tolerate about 10 minutes of drill and 50-60 min Tx
- Child, parent and clinician need to be resilient
- If four years old, need to have had Tx before

Multi-sensory Cueing:

* What combination of multi-modal input works best for your child. Initially, offer the highest level of support to establish a new phoneme or motor pattern, and then immediately begin to fade supports.

- DTTC
- Which tools in your box work for THIS client?
- Hand signals: Easy Does It; Marshalla; Speech EZ
- Touch cues: PROMPT
- Randomized v. Blocked Practice
- Verbal Feedback: Knowledge of Results v. Knowledge of Performance
- Backward chaining
- Prosody

Randomized vs. Blocked Practice:

- Blocked practice (limited targets presented in the same order) is best when trying to establish a skill
- Randomized practice (random mix of targets and reinforcement) is best when trying to generalize a skill.

Knowledge of Performance vs. Knowledge of Results:

- Knowledge of Performance is very specific feedback provided to the child by the therapist. Examples include: “I like how you closed your lips for /m/,” or, “Remember to push your lips out.”
- Consider Co-Articulation: To elicit /pi/, “lips together, smile, make your popping sound.” To co-articulate /pi/ you must reinforce articulatory postures that take into account the co-articulatory posture. The smile, going into the popping sound assists production of /i/.

Knowledge of Results:

- When the therapist or the student provides simple feedback as to whether the target was met or not.
  - Therapist or parent provides the feedback, "That was a great /l/,"
    - When the therapist or parent provides the feedback, it's instructional.
  - Student provides the feedback, "Was that a good one?"
    - But for the child to engage in *true learning*, the child should provide the feedback as to whether the production hit the target.
  - This should only be solicited when the child is able to provide good productions.
- So when should knowledge of performance and knowledge of results to applied?

Backward Chaining

- A technique for working on combining syllable shapes.
- Ex.:Establish a motor plan for the second half of a CV: /ti/ through DTTC
- Then reintroduce the target word, and cue, "You say, /pa/,"
- The client says, /pa/, the SLP is using hand signals, miming, initial sound cues or other multi-sensory cueing to elicit /ti/ for a co-articulated production of /pati/.

Prosody

- Goal to work on prosody as soon as clients provide consistent productions. This helps vary motor-plans to adapt for lexical stress in longer utterances.
- Early on you can pretend to be characters: "Say it like a monster," "Say it like an ambulance," "Say it like a baby."
- Later on work on varying lexical stress as soon as utterances enter the motor plan: I go now; I GO now; I go NOW.

Putting it all together

- At what syllable shape level does accuracy break down?
- What are phonemes within the repertoire?
- Focus building/stringing syllable shapes
- Pick targets containing syllable shapes within the client's repertoire and build from there for success.
- **Goal of using phonemes within repertoire and compensatory placements, along with multi-sensory cueing, to shape intelligible approximations for a functional core vocabulary
- Power Phrases
- Compensatory placements. What approximation will make the child's communication intent successful
- What level of cueing is required for success? Multi-sensory… Sign language, hand cues..
- How can I immediately move the activity to so the child is learning and not prompt dependent? DTTC. Build motor pathways

Phrase and Sentence Level

- As client moves from polysllabics to phrases and sentences
- Need to focus on "functors" (little words)
- Need to focus on grammatical morphemes
- Velleman's grammatical morphemes (Brown's)
- Need to focus on natural prosody and lexical stress from the very beginning

How much therapy is recommended to address CAS?:

- While there are many degrees of severity and not everyone will require the same level of intensity, it is generally recommended by ASHA and CASANA that sessions remain 30 minutes in length and be as frequent as possible, such as 4 sessions per week.

Evidence Based Practice

- Provide access to AAC
- Minimize pressure to speak: simultaneous production, puppets
- Imitate the child.
- Utilize Exaggerated Intonation and slowed tempo
- Augment Auditory, Visual, Tactile, and Proprioceptive Feedback
- Avoid Emphasis on Nonspeech - Like Articulator Movements (oral motor): Focus on Function
- Choose targets salient to that child… in, on, wow,
- Choose Power Words/Phrases (no… go away)

Resources for Parents:

- CASANA: www.apraxia-kids.org
- Margaret Fish book:
  - *Here's How to treat Childhood Apraxia of speech*
- Facebook groups: Apraxia Kids, CASANA, Apraxia in Metro Atlanta

Good materials for therapy:

- For drills, choose games that provide many opportunities for reinforcers (provide 10 trials, then offer reinforcer, to keep child interested).
  - Pop-up Pirate, bubbles, Jumping Jack, Honey Bee Tree, Crocodile Dentist, Gooey Louie
- If drills don't work for your child, or if the child is ready for phrase level practice, choose games that can require adjustable levels of communication cueing, but still incentivizes the child.
  - Feed the Woozle, Zingo, Shopping Lis)
- If cueing needs to be child centered, consider your child's target motor sequences and phonemic repertoire. Model what the child is doing or interested in. Use your DTTC/multisensory! SLOW model with overemphasis on vowels and consonants.