

What Do You Suspect? Let's Talk CAS!

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Disclosures


Dr. Carol Koch
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Disclosures:

Financial: I receive a salary from Samford University. I received a registration waiver for this conference. I have products with Bjorem Speech Publications. I receive textbook royalties from Jones & Bartlett Learning.


Nonfinancial: Serves on ASHA 2024 Topic Committee for Speech Sound Disorders in Children with Normal Hearing



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Learning Objectives

- After attending this session, participants will be able to:
 - Describe the primary diagnostic features of CAS
 - Describe primary strategies for CAS assessment
 - Describe primary strategies for CAS intervention
 - Write SMART goals for intervention planning

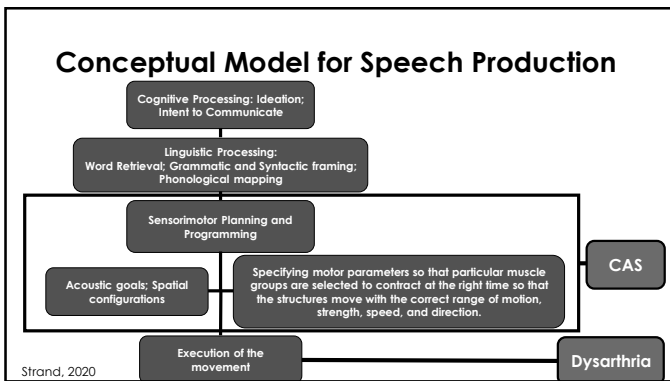


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CAS Definitions and Characteristics



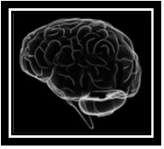
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Apraxia

- Apraxia of speech: a problem with the ability to plan movement (praxis)
 - Usually caused by some determined (acquired) or undetermined (developmental) problem in the cortex of the brain
 - Increasing evidence for genetic differences
 - The brain has problems planning to move the body parts (lips, jaw, tongue) needed for speech production
 - Inability to sequence speech movements
 - Not because of weakness or paralysis, or deficits in peripheral motor or sensory function, cognitive function, receptive language



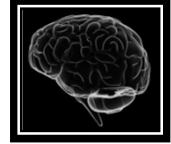
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Childhood Apraxia of Speech

- ASHA (2007) definition:
 - “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”, noting that
 - “the core impairment in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody”

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- Apraxia of speech is a **SPEECH LABEL** for difficulty planning and programming movement for speech. Our brains plan and program the movements needed for speech including the tongue, lips, jaw, palate, vocal folds, and diaphragm. Our brains also must judge when to move, at what speed, in what direction and distance for the movement, how much muscle contraction...



ALL AT THE SAME TIME.

CAS is when there is a disconnect in the ability to plan out and program these movements, impacting the movements needed for speech production and prosody.

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Three key features of CAS

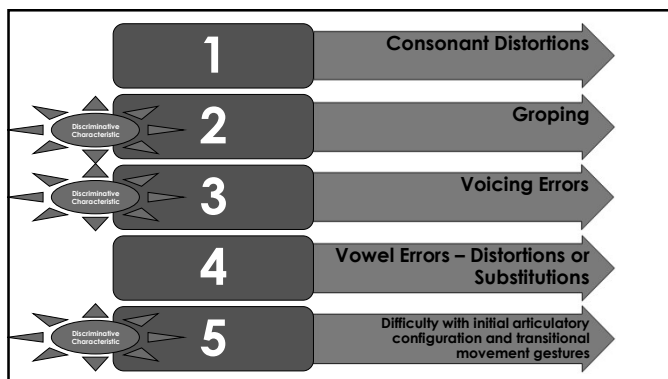
- ASHA (2007) identifies three key features that differentiates CAS from other speech sound disorders:
 - Inconsistent errors on consonants and vowels in repeated productions of syllables and words
 - Lengthened coarticulatory transitions between sounds and syllables (inappropriate pauses)
 - Inappropriate prosody, especially in the realization of lexical or phrasal stress (rhythm, melody and stress)

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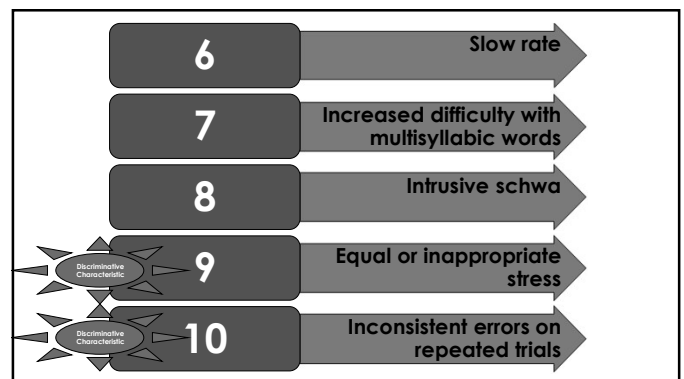
Pediatric Adaptation of the Mayo 10



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- Strand (2003) proposes that there are five key potential diagnostic characteristics of apraxia in young children. The five characteristics identified by Strand are:
 - *Difficulty in achieving and maintaining articulatory configurations*
 - *Presence of vowel distortions*
 - *Limited consonant and vowel repertoire*
 - *Use of simple syllable shapes*
 - *Difficulty completing a movement gesture for a phoneme easily produced in a simple context but not in a longer one*

(Strand, 2003, p. 77)

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Diagnostic Features

- According to ASHA, there is no definitive list of concomitant features which affect individuals with CAS.

(ASHA, 2007)

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Principles of Motor Learning

- Motor Learning: "set of processes associated with practice or experience leading to relatively permanent changes in the capability for movement" (Schmidt & Lee, 2005, p. 302)
 - Acquisition and learning stage: establish ability to execute the specific motor skill
 - Retention and transfer stage: the learning that is considered permanent

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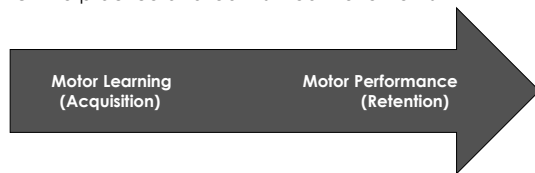
Motor Learning Principles

- Motor-based approaches focus on the placement and movement of the articulators
- Principles that support how speech motor learning occurs:
 - Prepractice goals
 - Principles of practice
 - Principles of feedback

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Principles of Motor Learning

- HOW to practice and *learn* skilled movements



(Schmidt & Lee, 2005; Maas, et al., 2008)

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Principles of Motor Learning

- How We PrePractice:
 - Motivation
 - Understanding of task
 - Stimulability
- How We Practice:
 - Mass Practice
 - Distributed Practice
 - Blocked Practice
 - Random Practice
 - Target Complexity
- How We Give Feedback:
 - Immediate Frequent Feedback
 - Delayed or Random Feedback
 - Knowledge of Performance
 - Knowledge of Results
 - Fading so that child does not become cue dependent

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Motor Learning Principles - Overview

To ACQUIRE a skill
(Motor Performance)

Knowledge of performance
Frequent feedback
Immediate feedback
Many trials per session*
Blocked practice
Constant practice
Small stimulus set
Simple targets

To RETAIN a skill
(Motor Learning)

Knowledge of results
Less frequent feedback
Delayed feedback
Many trials per session
Random practice
Variable practice
Large stimulus set
Complex targets

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Movement Sequences

- Therapy for apraxia of speech is not therapy for sound production, it is for the movement sequences needed to connect sounds for speech
- Identify sounds child does have and build on that, rather than sounds missing from inventory

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Assessment: Differential Diagnosis

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Who can diagnose CAS?

YOU!!!

According to the ASHA position statement, SLPs trained in the diagnosis of apraxia of speech are the professionals responsible for making the primary diagnosis of CAS.

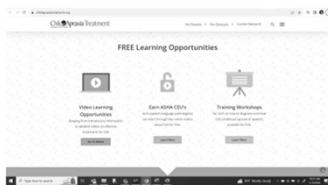
CAS is a SPEECH diagnosis, not a medical diagnosis!



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Professional Development

- <https://childapraxiatreatment.org/>



Child Apraxia Treatment
Once Upon a Time Foundation

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Assessment

- Roles and Responsibilities
 - Who diagnoses CAS anyway?
 - According to ASHA, SLPs **trained** in diagnosis of CAS are the professionals responsible for making the primary diagnosis of CAS.
- Case History
- Direct Assessment
 - NSOME
 - Motor Speech Exam
 - Sound Inventory
 - Core Word Inventory
 - Cue Assessment

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Early Characteristics

- Decreased or lack of babbling
- Groping, lack of flexibility when imitating speech
- Delayed onset of first true words – later than 12 months
- Limited intonation
- GHOST words – words are used and then disappear
- Simple syllable shapes and vowel errors
- Difficulty establishing and maintaining articulatory postures

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Early Signs Observed in Birth - 2

- | | |
|--|---|
| <ul style="list-style-type: none"> • Limited vocalizations • Little babbling before 12 months • Difficulty with feeding • 1st word after 12 months • First consonant after 12 months • Mostly vowels 13-18 months • Delayed onset of first true words – later than 12 months • 3 or fewer consonants by 16 months of age • 5 or fewer consonants between 17-24 months • Lack of velars or posterior sounds in first 24 months | <ul style="list-style-type: none"> • Dependency on bilabials, alveolars, stops and nasals in first 24 months • Few voiceless sounds • Simple syllable shapes (V and CV) • Groping for sounds and in imitation • Difficulty establishing and maintaining articulatory postures • Limited sound inventory • Decreased intelligibility • Limited intonation • Stops using words previously produced |
|--|---|



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Dynamic Assessment

- Case History/Parent Interview
- Early Signs
- Oral-Facial Exam
- Informal Motor Speech Assessment
- Non-Speech Oral-Motor Exam
- Speech Sample
- Sound Inventory
- Power Words and Core Words
- Percent Consonants Correct
- Language Testing



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Motor Speech Examination

- Examine the ability to sequence phonetic segments in **various contexts**
 - V, CV, VC, CVC (using various vowels)
 - Monosyllabic word repetition
 - Multisyllabic word repetition – various word shapes
 - Phrase repetition
 - Repetition of sentences of increasing length
- Compare automatic speech (counting) to novel utterances
- DEMSS: criterion-referenced for ages 3 and up or severely speech impaired, even children considered minimally or functionally nonverbal
 - Focus on movements for speech
 - Help with judgments of severity and prognosis
 - Tool for treatment planning and target selection
 - Overall articulatory accuracy, vowel accuracy, prosodic accuracy and consistency are scored.
 - Speech production across targets that vary in length and phonetic complexity and organized in a syllabic hierarchy
 - Cueing is allowed to improve accuracy and gain intervention insight
 - Dynamic assessment vs static assessment

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Articulation/Phonologic Analysis

- Standardized articulation tests (static)
- Use GFTA in conjunction with KLPA to obtain
 - Phonetic inventory and phonologic analysis
 - Percent consonants correct: compare single word production to sentence
 - Syllable shape inventory at various word lengths

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What about children younger than 3?

- Can we diagnose CAS during the prelinguistic period?
- For differential diagnosis, do we need:
 - Meaningful linguistic utterances
 - Moderate inventory of sounds
- Can motor programming/planning deficits affect early speech-like vocalizations, babbling, protosyllabary?



Overby & Highman, 2021

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What might early intervention look like?

- Parent education:
 - Activities focused on imitation of word shapes and sounds
 - Encourage vocalizations and communication more broadly
 - Expanding phonetic inventory
 - Use of various syllable shapes



Overby & Highman, 2021

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Treatment Planning

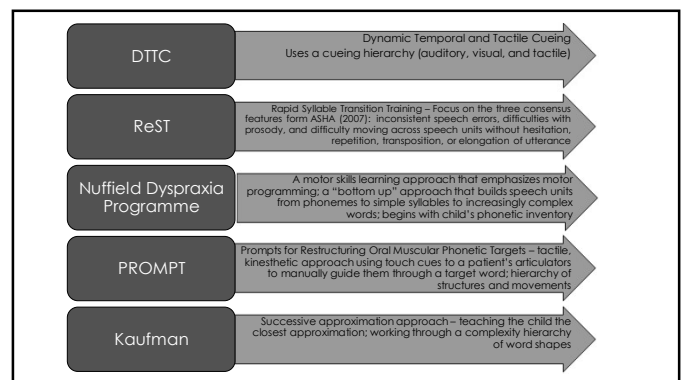
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Treatment of CAS

- Little empirical support for any specific approach
- Focus on building a functional vocabulary
- Initially, emphasize syllable level production
- Core Vocabulary may be appropriate
- Augmentative/alternative communication (AAC)
- Production intervention should focus on motor planning rather than specific phonemes
- Expand phonetic inventory and syllable shapes, gradually moving to longer and more complex sentences.

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ReST

- Sounds – accuracy of speech sound production
- Beats – stress patterns, syllable patterns, prosody
- Smoothness – movement transitions, fluency



<https://rest.sydney.edu.au/cases/step-by-step/>

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Nuffield Dyspraxia Programme



• <https://www.ndp3.org/treatment-approach/>

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DTTC

- Provides the most support with auditory and visual attention
- Slowed rate, elongating vowels
- Move toward normal rate, correct movement gestures, and no groping
- Vary prosody
- Slowly fade volume to a simultaneous mime only
- When accuracy is achieved move to direct imitation

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DTTC

- Therapist provides an auditory model of target while child watches
- Child repeats target
- If support is needed, clinician can go back to simultaneous production, or mime the movements as the child repeats
- Fade miming, vary prosody
- Add or fade cues as needed for success

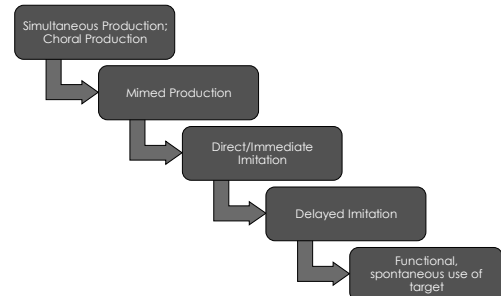
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DTTC

- When child is producing the utterance in direct imitation, with normal rate, accurate movement gestures, and is able to vary prosody....
- Clinician adds a 1-2 second delay before child imitates
- Miming can be very helpful at this point
- If more support is needed, go back to direct imitation
- Fade miming and vary prosody

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DTTC Hierarchy



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Simultaneous/Choral Production

- Provides the most support with auditory and visual attention
- Slowed rate, elongating vowels
- Move toward normal rate, correct movement gestures and no groping
- Vary prosody
- Slowly fade volume to a simultaneous mime only
- When accuracy is achieved move to Direct Imitation

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Direct Imitation

- Therapist provides an auditory model of target, while child watches
- Child repeats target
- If support is needed the therapist can go back to simultaneous production
- OR mouth the movement gesture (miming) of child as child imitates simultaneously
- Fade miming, vary prosody
- Add or Fade cues as needed for success

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Delayed Imitation

- When the child is producing the utterance in direct imitation, with normal rate, accurate movement gestures, and is able to vary prosody...
- Clinician adds a 1-2 second delay before child imitates
- Miming the movement gesture as child repeats can be very helpful at this point.
- If more support is needed the therapist can go back to direct imitation.
- Fade miming, vary prosody

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Treatment Planning

- What is your goal?
 - The goal is written differently than traditional speech goals targeting specific sound(s).
 - The goal targets MOVEMENT over syllable/word shapes incorporating sounds in the child's repertoire.
 - Goals should reflect the specific syllable shapes and movement gestures rather than sounds in particular word positions
 - Goals should be written to reflect an increase in the flexibility and reliability of the child's motor system with emphasis on coarticulatory transitions between sounds and syllables

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What is so important about target selection?

- Can mean the difference between success or little success
 - Child feels frustrated
 - Clinician feels defeated
- KEYS:
- Choose fewer targets
 - Functional, natural targets
 - Build on child's phonetic inventory



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Target Selection

- Phonetic inventory
- Syllable shape
- Core words
- Power words
- Functional targets
- Apraxia goals – remember the goal is MOVEMENT



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Target Word Considerations – Word Shapes

VC	Consonant + vowel	Boo, me, no
VC	Vowel + consonant	Up, in, out, eat
VCV	Vowel + consonant + vowel	"aw gaw" for all gone; "opa" for open
CVC	Consonant + vowel + same consonant	Pop, none, mom, dad, sis
CV ₁ C ₂	Consonant + vowel + different consonant	Bat, boom, bus, boof, mess
C ₁ V ₁ C ₁ V ₁	Same consonants + same vowels	Mama, dada, baba, boo-boo, bye-bye, no-no, pee pee, nai-nai, nana
C ₁ V ₁ C ₁ V ₂	Same consonants + different 2 nd vowel	Mommy, daddy, bubo, puppy, cookie, sissy
C ₁ V ₁ C ₂ V ₂	2 different consonants and 2 different vowels	Teddy, bunny, funny, potty, kitty laco, messy
CV ₁ CV ₂	Different consonants and different vowels	Wagon, bottom
CV ₁ CV ₁ CV ₂	Different consonants and different vowels	Patato, pajama, banana
Build phrases from above		Nai-nai teddy, mama bee, dada bee
3 syllables	Different consonants and different vowels	Animal, elephant, silly goose, piano, hospital
4 syllables	Different consonants and different vowels	Macaroni, elevator, basketball, motorcycle
5 syllables	Different consonants and different vowels	Electricity, peeling banana,

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Common Apraxia Targets

VC	VCV	CV	CVC	CVC (cont)	CVCV	CVCV	CVCV	CVCVCV
Up	Oh no	Me	Bed	Fun	Mama	Mommy	Teddy	My mommy
On	Aw gaw	Hi	Hot	Cut	Dada	Daddy	Potty	Nai-nai teddy
In		Bye	Mine	Yes	Nai - nai	Baby	Bunny	
Off		See	Feet	Nap	Papa	Puppy	Happy	
Out		Go	Bone		Nana	Bubbo	Tummy	
Eat		You	Cup		Booboo	Bumbo	Wanna	
Ow		Bee	Bus		No no		Dunno	
Ouch		Boo	Mess		Nini		Messy	
		Pee	Sad				Dino	
		Poo	Hop					
		Two	Wet					
		No	Cat					
		Yah	Dog					

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SMART Goals

- Specific
- Measurable
- Attainable
- Relevant
- Time-Based



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TARGET – 8-Point Scale Scoring Rubric

8	7	6	5	4	3	2	1
Unable to produce target word	Child is able to produce word in simultaneous production. (able to show variation of prosody and connected sounds e.g., no segmenting)	Child is able to produce target correct in direct imitation with multi-sensory cueing.	Child is able to produce target in direct imitation without cueing, correct stress and prosody	Child is able to produce the target correctly in delayed imitation with multi-sensory cueing.	Child is able to produce the target in delayed imitation without cueing, correct stress and prosody.	Child is able to produce the target word spontaneously with multi-sensory cueing.	Child is able to produce the target spontaneously.
8	7	6	5	4	3	2	1

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Sample Goals (components)

Kimberly will:

- Use correct planning and programming of movement sequences for CV, VC, VCV, CVC, and CVCV targets while using phonemes in her phonetic inventory achieving a "1" for each target word as judged by the clinician utilizing the 8-point scoring rubric.
- Use correct planning and programming of movement sequences for multisyllabic words and phrases using sounds in her phonetic inventory achieving a score of "1" for each target word as judged by the clinician using the 8-point scoring rubric.
- Use correct planning and programming of movement sequences for pivot phrases using sounds in her phonetic inventory achieving a "1" for each target phrase as judged by the clinician using the 8-point scoring rubric.

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Chaining

- Backward
- Forward
- Full-Word



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Knee

Knee

Knee

Bu+



Knee

=



bunny

Backward Chaining

54



Shoe

Shoe

Shoe

Ti+



Shoe

=



Tissue

Backward Chaining

55

Rah Rah Rah

Rah + 10 = Rotten

Rah Ten Rotten

Forward Chaining

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Car Car Car

Car + Pet = Carpet

Car Pet Carpet

Forward Chaining and Whole-Word Chaining

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Other Treatment Strategies

scsha

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Cues and Feedback are Key Tools

- Tactile Kinesthetic Cues – touch, tapping, singing
- Visual Cues – mirror, mime, pictures
- Auditory Cues – reducing rate, simultaneous production, imitation
- Metacognitive Cues – signs, placement cues, metaphors

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Key Therapeutic Considerations

- **Trust**
- Create a bond
- Client buy-in
- Understanding of movement
- Symbols and meaning are linked in the brain whether they are words, gestures, images or sounds
- Gestures play a role in conceptualizing the verbal message
- Identify emotions – give them words
- Show compassion
- Be bold

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WATCH ME! Some great tips!

- **EYES ON ME!**
- When you watch me, it will help you!
- Use video!
- Avoid negative prompts – “stop, watch me”
- Sticker on nose, hand visor, bring child’s hands to your face

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Placement Cues and Awareness



- Help child understand our placement cues
- Do this before practice so child understands the terms

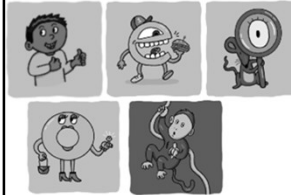
- Tight vs loose
- Lips out vs lips back
- Open vs closed
- Tongue tip up

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Vowel errors



CV practice - /p, b/ with long vowels



- Clinicians need to develop strong vowel perception
- Help child to understand small shifts in tongue and jaw position make a big difference – provide jaw stability when needed
- Work on vowel identification and discrimination
- Practice CV and VC combinations to establish flexibility early in intervention
- Practice vowels in isolation or as animal sounds or with sound cues “e-e-e” pretending to eat
- Use of minimal pairs to show meaningful semantic differences

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Prosody

- Model varied prosody and correct stress
- Work on expanding vocal range...Sing or use voices!
- Model incorrect prosody so child can hear the difference
- Older children - discuss how stress changes meaning
- Begin working on prosody early on
- Work on prosody within play to make it functional

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Voicing Errors

- Voice on sound vs. voice off sound
- Have child feel your throat for the soft buzz feeling
- Whisper
- Discriminating using minimal pairs
- Video feedback
- Extend voiceless sound with movement into the vowel
- Using your clinical judgment

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Sound Additions

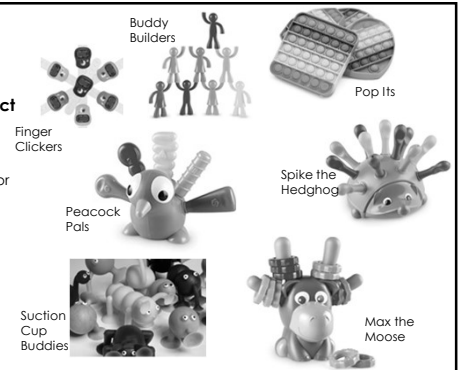
- Watch for sound additions... especially the INTRUSIVE schwa (STOP!)... use visual stop sign if needed



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GOAL:

- To get as many **correct** productions as possible
 - Use a clicker
 - Earn game pieces – for assembly or construction
 - Rapid Repetition Rounds
 - Rapid turntaking
 - Count on fingers
 - Rule of 5
 - Stickers or bingo markers



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More Therapy Tips and Tricks

- Use visuals to discriminate, to represent sound, movement, and prosody
- Record children so they can see and hear themselves
- Use simultaneous production for the most support – follow the DTTC hierarchy
- Be mindful of fading cues
- Use hand cues and signs
- Pair letters to sound cues

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- Rule of 3 Wait, stop talking so much! ☺
 - Give the gift of time!
- Modify targets, use successive approximations
- Backward chaining: knee, knee, knee, bunny
- Forward chaining: mou, mou, mou, mouse
- DO NOT repeat initial sounds in words
- Keep air flowing, do not segment words
- Teach an understanding of sounds and movement
- Make sure they understand the terminology you are using

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- Material management
- Therapy doesn't have to be fancy
- How do YOU say a phrase? Be mindful of co-articulation. Don't over-articulate
- Increase repetitions
- Include music, slow down your singing, and incorporate prosody
- Use movement – rocking chairs
- Include minimal pairs
- Use all the cues!

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QUESTIONS?

- Remember:
- Childhood apraxia of speech involves difficulty with the planning and programming of the movements needed to speech production
 - We observe:
 - Inconsistent errors on consonants and vowels in repeated productions of syllables and words
 - Lengthened coarticulatory transitions between sounds and syllables (inappropriate pauses)
 - Inappropriate prosody, especially in the realization of lexical or phrasal stress (rhythm, melody and stress)



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