UPDATE on Interventions for Childhood Apraxia of speech

Rebecca McCauley, Ph.D., CCC-SP, BRS-CL
Professor, Department of Speech and Hearing Science
The Ohio State University

Ohio School Speech Pathologist and Educational Audiology Coalition
October 11, 2015

Financial Disclosure

The presenter’s financial interests consist of co-authorship of a test that is in press and co-editing of two books that may be referred to in the course of her presentation. She is also employed at the Ohio State University.

Goals for today’s talk

• Review basic characteristics associated with CAS, including frequently co-occurring problems
• Introduce a set of principles for planning treatment for children with CAS
• Outline principles of motor learning that can be incorporated into many potentially valuable interventions
• Introduce 3 specific interventions identified as having the best research support for use with children with CAS
• Identify sources for information about new interventions
The plan for this morning

Part 1. CAS
• Core deficits/symptoms
• Other problems and similarities to other severe speech sound disorders

Part 2. Intervention Planning
• A comprehensive intervention will need to consider all communication challenges
• Evidence based interventions
• Finding new interventions that merit investigation—easier than ever

Part 1. Introduction to CAS
• Basic—definitions and background
• Similarities and differences between CAS and other severe speech sound disorders

What is CAS?
“A neurologic pediatric speech sound disorder in which precision and consistency of movements is affected, in the absence of neuromuscular deficits”

associated with problems in

“Planning and programming the spatiotemporal movements for speech which causes problems with speech sound production and prosody”

(ASHA, 2007, p. 2)
Three contexts for CAS

**Idiopathic** – Unknown origin

**Syndromic** - In association with complex neurobiological disorders of a genetic or metabolic nature – e.g., Fragile X, Galactosemia, Autism, Velocardiofacial syndrome (22q11.2)

**Acquired** – e.g., intrauterine stroke, infection, trauma

(ASHA, 2007)

What distinctive characteristics have been identified?
1. Inconsistent errors on Cs and Vs in repeated productions of syllables or words
2. Lengthened and disrupted coarticulatory transitions between sounds and syllables
3. Inappropriate prosody, especially in the realization of lexical or phrase stress

(ASHA, 2007, p. 2)

1. Inconsistent errors on Cs and Vs in repeated productions of syllables or words
   - **Definition**: Similarity of word production
   - Examples:
     - kangaroo: [kæŋɡəroʊ], [kæŋɡəroʊ], [kæŋɡəroʊ]
     - elephant: [ɪˈlefənt], [ɪˈlefənt], [ɪˈlefənt]
     - house: [haʊs], [haʊs], [haʊs]
     - teeth: [tɛθ], [tɛθ], [tɛθ], [tɛθ]
     - umbrella: [ʌmˈbrelə], [ʌmˈbrelə], [ʌmˈbrelə]
   - Code: 95

(Deehan, 1995)
Inconsistent errors in younger children on Cs and Vs

- speech samples than in elicited productions
- However, inconsistent errors may show up even among very young children and children with little speech
  - largely V, CV, CVCV
- Vowel errors can be particularly valuable to note given the generally early age at which these are acquired

Vowel errors in CAS

- children with developmental phonologic disorders
- Yet vowel errors are now recognized as more common in moderate/severe SSDs than had once been thought (Karen Pollock’s work)
- Possible reasons for underestimations:
  - SSD identification/description

2. Lengthened and disrupted coarticulatory transitions between sounds and syllables

- Probably contribute to perceptions of stress and other prosodic abnormalities
- May be related to observations of
  - Gropping
  - Syllable segregation = inappropriate pauses during speech
- Clinically may depend on observations during “difficult speaking conditions,”
  - Multisyllabic word production
  - Connected speech
  - Motor speech examinations in which a hierarchy of phonetically more complex stimuli are used (e.g., mom, mommy, hi, mom; hi, mommy)
3. especially in the realization of lexical or phrasal stress

- Recall that prosody relates to characteristics of speech affecting multiple segments. It includes phenomena such as phrasing, rate, and stress.

- Most commonly observed abnormality: Equal-excessive stress.

- Frequently, assessment is relatively subjective, and would be based on examination of connected speech and/or multisyllabic words.

Graphic representation of equal, excessive stress

<table>
<thead>
<tr>
<th>Correct Stress</th>
<th>Excessive Equal Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>'banana'</td>
<td>'puppy'</td>
</tr>
<tr>
<td>buh NAE nuh</td>
<td>PUH PEE</td>
</tr>
</tbody>
</table>

Let's listen to a child talking with Shelley Velleman

- several words and sentences
- Notice stress patterns
Sources of information for identifying consensus discriminative characteristics

- Identified in ASHA (2007)
- Used often as basis of operational definitions of CAS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Example</th>
<th>Sources of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Inconsistent errors on Cs and Vs in repeated productions of syllables or words</td>
<td>“teeth” vs “teeth”</td>
<td>Speech sample, Motor-speech examination, Multi-syllabic word list, DEAP (Dodd et al.) consistency subtest (3 to 8:11)</td>
</tr>
<tr>
<td>2. Lengthened and disrupted coarticulatory transitions between sounds and syllables</td>
<td>Groping on initial and subsequent syllables</td>
<td>Speech sample, Motor-speech examination, Observations during artic testing</td>
</tr>
<tr>
<td>2. Inappropriate prosody, especially in the realization of lexical or phrase stress</td>
<td>Excessive, equal stress, BAHUH HAH HAH not “banana”, TE FO not “telephone”</td>
<td>Speech sample, Motor-speech examination</td>
</tr>
</tbody>
</table>

Other descriptions of speech differences in CAS
A checklist from the Mayo Clinic

<table>
<thead>
<tr>
<th>Segmental errors</th>
<th>Suprasegmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>8) Syllable segregation</td>
</tr>
<tr>
<td>2)</td>
<td>9) Slow rate</td>
</tr>
<tr>
<td>3)</td>
<td>10) Slow diadochokineti rates</td>
</tr>
<tr>
<td>4) articulatory configurations or transitory movement gestures</td>
<td>11) Equal stress or lexical stress errors</td>
</tr>
<tr>
<td>5) Groping</td>
<td>At least 3 characteristics across 3 tasks</td>
</tr>
<tr>
<td>6) Intrusive schwa</td>
<td>Used for adults and children</td>
</tr>
<tr>
<td>7) Increased difficulty with multisyllabic words</td>
<td></td>
</tr>
</tbody>
</table>

What additional problem areas have been reported?

- With speech sound (process use, residual articulation errors)
- Risk for genetic abnormalities
- Speech perception
- Attention
- Morphosyntax
- Phonological awareness
- Spelling, reading, writing, and other academic areas

Similarities among severe SSDs

Speech
- Reduced intelligibility
- Reduced phonetic repertoire, including some vowel errors
- Increased use of patterned errors (e.g., those well described using phonological processes)

Increased likelihood of related problems
- Oral language risk
- Literacy
- Social interaction/communication

Speech Production Needs

Needs Shared by all Severe SSDs
- Reduction in phonological simplifications
- Increased phonetic/phonemic inventory
- Generalization/Motivation

Additional Needs Specific to CAS
- Attention to Motor Learning*
- Attention to specific kinds of errors that are relatively rare in other SSDs
  - Vowels
  - Prosody

*Although children with other SSDs may benefit as well

Group exercise

(1) do the specific speech differences described for CAS fit your experience with these children?
(2) do the kinds of broader problems just listed fit your experience?
(3) how is clinical management affected by these symptoms? By these broader problems?
Part 2. Intervention planning

- Principles guiding intervention
  - for SSSDs
  - Speech interventions particular to CAS

Possible targets for treatment

<table>
<thead>
<tr>
<th>Co-occurring language problems</th>
<th>Speech production</th>
<th>Functional outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral language</td>
<td>Motor speech planning</td>
<td>Intelligibility</td>
</tr>
<tr>
<td>• receptive/expressive</td>
<td>Phonology</td>
<td>Comprehensibility –</td>
</tr>
<tr>
<td>semantics/syntax/</td>
<td></td>
<td>understandability</td>
</tr>
<tr>
<td>morphology/pragmatics</td>
<td></td>
<td>when using context,</td>
</tr>
<tr>
<td>Written language</td>
<td></td>
<td>gestures, as well as</td>
</tr>
<tr>
<td>• Phonological awareness/</td>
<td></td>
<td>repair strategies</td>
</tr>
<tr>
<td>Reading/writing/spelling</td>
<td></td>
<td>are considered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Literacy</td>
</tr>
</tbody>
</table>
**Be guided by the ICF--**

Be comprehensive in your treatment planning!

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**Broader effects of CAS**

ICF and ICF-Youth of the World Health Organization —

- **Body functions and structure** → Breakdown in speech production and Reduced intelligibility
- **Activity** → Reduced communicative competence
- **Participation** → Lack of peer acceptance; reduced access to teachers/information in classroom

→ about broader intervention strategies

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**Thinking about the ICF for more comprehensive intervention**

**Functional Limitation** → Breakdown in speech production and intelligibility

→ What can you change that affects intelligibility in addition to child’s speech?

- Room acoustics?
- Listener hearing?
Limitations on activities

- What can change to improve communication in context and social interaction?
  - Use AAC strategies?
  - Increase use of gestures?

Limitations on Participation

- acceptance and access to teachers/information in the classroom?
  - Peer & teacher education by you and/or the child with CAS
  - Programs to prevent/reduce bullying in and outside of class

Group exercise

- Thinking of children with CAS or other severe speech sound disorder, write down one thing
  - you have done to address the child’s activity/participation limitations.
  - OR that you could do to address the child’s activity/participation limitation
  - Talk to your neighbor about it.
Part 2. Intervention planning

- Principles guiding intervention
- Speech and other interventions with wide applicability
- Speech interventions particular to CAS (more or less)

Treatments for unintelligibility and reduced phonetic inventory

1. the child who will not imitate
2. Stimulability intervention
3. Modified cycles approach

1. Management of unintelligible and young children

- Regardless of etiology, certain core elements need to be represented in the plan that address problems in speech, language, and communication
- Improve speech production/linguistic use of sounds
- Improve language skills (vocabulary)
- Improving communicative success (comprehensibility/quality of interactions/life)
When “Simon says” doesn’t work
Alternatives to imitation

• Author’s strategy:
  Identify strategies for use with this population that have at least some research support
• Level 2 = at least 1 experimental or quasi-experimental design on a relevant population

(DeThorne, Johnson, Walder, & Mahurin-Smith, 2009)

Population of interest: Children who won’t imitate
– Includes children with CAS as well as those with many other etiologies, including other severe speech sound disorders, autism, cognitive impairment...
– Often encourages clinicians to pursue nonverbal oral motor exercises (for which there is very, very little research evidence & equally little theoretical grounding in physiology, especially neurophysiology)

Evidence-based strategies for eliciting speech-like vocalizations

1. Communication
   – AAC is now viewed as helping language learning, not just providing a different modality
   – If a nonvocal AAC strategy (e.g., sign) is used, voice/vocalization can be encouraged to increase speech output
   – If a device with vocal output is used, modeling is increased
1. Why? Negative effects of anxiety on motor performance

2. Avoid direct requests for imitation, model instead and encourage turn-taking – Distract attention away from speaking to having fun – using a puppet, – Simultaneous productions – Follow the child’s lead

3. Reduces production demands because the form is familiar and may ultimately be shaped toward a more adult like form

4. In normal development, imitation of the child builds imitation by the child and allows the adult to assign meaning to a child’s perhaps non-linguistic vocalization

• Why? NegaEve effects of anxiety on motor performance

• Avoid direct requests for imitation, model instead and encourage turn-taking

• Reduces production demands because the form is familiar and may ultimately be shaped toward a more adult like form

• In normal development, imitation of the child builds imitation by the child and allows the adult to assign meaning to a child’s perhaps non-linguistic vocalization

3. Imitate the child

• Reduces production demands because the form is familiar and may ultimately be shaped toward a more adult like form

• In normal development, imitation of the child builds imitation by the child and allows the adult to assign meaning to a child’s perhaps non-linguistic vocalization

• Child: ba

• Adult: “oh, ball”

4. Use exaggerated intonation and slowed tempo

• Rationale: Making speech more music like may enlist the right hemisphere

• Improved prosody -> improved intelligibility

• Evidence – primarily a single subject design and a nonsense word learning task (Kouri & Winn, 2006) showed greater imitations occurring in a sung vs. spoken task

• Strategies, especially for introducing 2 word utterances, (e.g., light on, all done)

5. Augment auditory, visual, tactile and proprioceptive feedback

• Feedback is greatest early in learning and later is reduced

• A focus on on movement may be helpful if sensory problems

• Methods of augmenting feedback

• or Strand’s methods

• Auditory – slight amplification

• PVC pipe

• Echo microphone

6. Avoid emphasis on nonspeech-like articulator movements

• Nonspeech movements of the articulators involve different parts of the brain than speech movements — therefore, this won’t help speech!

• Only use nonspeech activities in a limited way and when the child is not imitating speech sounds;

• Nonspeech activities that are used should be as close to speech movements as possible and transitioned to speech as quickly as possible
2. Stimulability Treatment

- Child is presented with a cast of characters, a set of colored drawings, and a set of gestures paired with target phonemes
- Imitation of sounds in isolation is encouraged, but not demanded
- Examples
  - /s/- Silly Snake “slinkily move finger up arm”
  - /theta/- Thinking Thumb “tap thumb on chin”
  - /p/- Putt putt Pig “hands move in a skating motion”
  - /m/- Munchie Mouse “Push lips together and rub tummy”

(Miccio & Elbert, 1996; Miccio & Williams, 2010)

Session Organization

- Elicit 1/3 of stimulability probe (5 min)
- Review of characters and their sounds (5 min)
- Activity I: Go fish (10 min)
- Activity II: Guess my card (10 min)
- Activity III: Spinner game (10 min)
- Elicit 1/3 of stimulability probe (5 min)

VIDEO CLIP FROM MICCIO & WILLIAMS (2010)
3. The Cycles approach

- Auditory stimulation (formerly “bombardment”)
- Production practice opportunities for a given phonological pattern (e.g., final consonants) for a small number of words
- Cueing allowed, but generalization is expected; in part because words are chosen that are emerging in production

(Hodson & Paden, 1991; Prezas & Hodson, 2010)

Adaptations to the Cycles approach to facilitate motor learning

- Increase number of trials
- Use a smaller set of words (a relatively small set is already recommended)
- Carefully arrange timing between model and the child’s attempt and modify over time (lengthen if successful)
- Use other facilitators
  - Slowed rate
  - Tactile and gestural cues

(McCauley & Strand, 1999)
Principles of motor learning

What are they? Ideas with fairly weak claims as “direct research evidence” but pretty strong “indirect” research evidence and strong theoretical rationales

- Research evidence
  - Studies of healthy adults, children – nonspeech, and more recently speech tasks,
  - A few treatment studies for children with CAS that varied one or more of these principles
- Theory that tie them together – Schema theory

Possible value? Incorporating them into our clinical “theories” and hypothesis testing

Sources: Moay, et al., 2008; Murray, 2014; Schmidt & Lee, 2014; Verdolini, 2000; Wong, Whitehill, Ma, & Masters, 2013

(1) Provide many practice opportunities

Just as with all skilled behavior, practice makes perfect—or at least permanent!

Terms used to talk about # of practice opportunities – dosage, intensity

# of sessions per week x # of teaching episodes per session x # of weeks

Ways to increase intensity of practice/dosage – especially the more severe the child’s problems

↑ session
↑ # of sessions per week: 2-3 per week (up to 60 min/ session)
↑ # of weeks: Very common strategy, but perhaps not the best
↑ use of home practice (may be especially important for maintenance and generalization)

*Yoshii & Gilchrist-Hearn, 2011; Murray et al., 2014; Namalakayan, et al., 2015; Thomas et al., 2016*
(2) Use **distributed practice**, rather than **massed practice**—especially initially and especially if problem is severe
- 10, 10, 10, 10 min
- 40 min
- One theoretical rationale: Opportunities to forget, then recall skill/knowledge may be very helpful to learning
- This recommendation applies to the development of difficult motor skills (violin, tennis) and difficult non-motor cognitive skills (e.g., algebra, etc.)
- Probably one of the most common recommendations re: CAS

(Campbell, Thomas, McCabe, & Ballard, 2014; Yorkston, Beukelman, Strand, & Hakel, 2010)

(3) Initially, use **blocked practice** then **as much as possible random practice**

**Blocked** = single target productions are grouped in blocks
Block 1: mom, mom, mom, mom, mom
Block 2: my, my, my, my, my
Block 3: me, me, me, me, me

**Random** = multiple targets are intermixed in each block
Block 1: mom, me, mom, my, me
Block 2: my, me, my, my, mom
Block 3: mom, my, mom, my, me

**Numerous studies show that blocked practice promotes immediate performance, but that random practice promotes longer term learning (retention and transfer)**

(Eide & Gildenstein-Neumann, 2011; Skelton, 2011; Skelton & Funk, 2006; Wong et al., 2013)

Thought experiment to illustrate this

Let’s compare our sense of what is happening in the following 2 tasks:

21/3 21/3 21/3 12/2 12/2 12/2 32/4 32/4

Vs.

21/3 12/2 32/4 12/2 21/3 32/4 12/2 32/4
Other ways of increasing “randomness” in practice - concurrent therapy

- within the child’s capability
  - 1 syllable; 2 or 3 word phrase, etc.
  - imitated or elicited (sentence completion)
- Include more targets per session - (e.g., f, v, s, z) - 10 words; 5 with sound in l and 5 in F position
- Note: moderate to high frequency of trials per minute yielding about 50 trials per 15 min.
- Good generalization from trained to untrained stimuli occurred regardless of the length of the untrained stimulus response length

(Skelton & Hagopian, 2014)

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**Early in learning**, provide feedback that is
- immediate,
- frequent,
- more knowledge of results than of performance

<table>
<thead>
<tr>
<th>FEEDBACK</th>
<th>KR Knowledge of results</th>
<th>KP Knowledge of performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>successful/not successful</td>
<td>YES: “That sounded like /w/, not /f/”</td>
</tr>
<tr>
<td></td>
<td>“that’s great! vs Not yet!”</td>
<td>NO: “You need to move your tongue back”</td>
</tr>
</tbody>
</table>

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**BUT later in learning**, outcome-focused, but less frequent and less immediate and more KR than KP

- Early – week 1-8; before 50% accuracy
- Late – after week 8; after 50% accuracy

**Early** – close to 100% & immediate
Trial 1… Trial 5… Trial 10… Trial 20… Trial 30… Trial 40

**Late** – close to 50% and delayed
Trial 1… Trial 5… Trial 10… Trial 20… Trial 30… Trial 40

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How this may work
Fading feedback and immediacy of feedback, may increase learner’s attention to and/or responsibility for processing (self-monitoring)
Why think about incorporating these principles in your clinical problem solving?

- adults/children with Apraxia of speech
- They may operate independently of other components of intervention
- They are being incorporated in most of the treatment approaches being tested by researchers

Consider the following principles of motor learning

- Which do you already do?
- Which might you do?
- What stops you?

1. Intensity (# of sessions; # of trials)
2. Distributed rather than massed practice
3. Random rather than blocked trials
4. Working toward infrequent/delayed feedback

Part 2. Intervention planning

- Principles guiding intervention
- Speech and other interventions with wide applicability
- Speech interventions particular to CAS (more or less)
Three interventions with the best support to date for CAS  
(Murray, McCabe & Ballard, 2014)

Nature of the Murray et al. study

A systematic review of treatment studies (single subject experimental designs, case series or descriptive studies)

- from 1970 to 2012
- minus really seem to fit the area of interest
- 42 articles examined for
  1. how well CAS was identified (using the 3 ASHA features)
  2. how big a treatment effect was seen immediately
  3. whether results were examined and found to show generalization
  Maintenance of skills

The most promising interventions

- Identified as worthy because of the current quality of their evidence and size of their effects

- Motor planning
  - DTTC: Dynamic Temporal and Tactile Cuing
    (Debertine, 2000)
  - ReST: Rapid Syllable Transitions
    (Robin, McCabe, & McDonald, 2010; Thomas, McCabe & Ballard, 2014)
DTTC: Dynamic Temporal and Tactile Cueing

- Based on integral stimulation techniques used for adults with apraxia to movement/articulatory accuracy
- Developed for children with moderate/severe CAS by Edythe Strand over the past 20 years

DTTC’s focus

For children with CAS

Dynamic Temporal and Tactile Cueing (DTTC)
- 6 studies

1. An articulatory approach designed to facilitate lots of movement practice
2. Targeted productions are functional real words
3. Uses imitations that begin at a level where success is expected
   Then increase in length and complexity and from blocked to more random sets
5. Cueing strategies include
   – Simultaneous production
   – Slowed rate, and
   – Tactile/gestural cues
6. Over time a delay between model and imitation is added (simultaneous; mimed with child; immediate imitation; delayed imitation)
7. As articulatory accuracy improves, prosodic features (intonation, loudness, and rate) [to avoid “teaching abnormal prosody”]

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**Structure of DTTC**
(Strand & Skinder, 1999)

- **Direct Imitation**
  - Simultaneous Production
  - Add tactile cues

- **Incorrect**
  - Continue until normal rate & prosody

- **Correct**
  - Add delay

- **Incorrect**
  - Correct

- **Incorrect**
  - Add delay up to 3 seconds
  - Back up to direct imitation

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**Video Clip of DTTC**

*Video Clip 2A*

DTTC
(with thanks to Edythe Strand)
ReST: Rapid Syllable Transition Treatment

- Developed to treat abnormal prosody in CAS for children with mild/moderate CAS over about the past 5 years
- Developed by Kirrie Ballard, Donald Robin, and Patricia McCabe

Ballard, Robin, McCabe & McDonald, 2010; Thomas, McCabe & Ballard, 2014

ReST’s focus

Communication effectiveness
Language & communication problems
Overall speech sound problem
Core deficit affecting prosody

For children with CAS

ReST: Rapid Syllable Transition Treatment – 3 studies

1. Developed to address core problem in lexical stress in multisyllabic words
2. Outcomes examined in the 2 studies on this thus far effects on stress and to a lesser extent segmental accuracy
3. Intervention initially tested as 4x per week for 3 weeks; then 2 x per week for 6 weeks → similar results
4. Principles of motor learning used in the ReST
   • High intensity of practice (1 hour x 4x per week with 100-120 practice trials per session)
   • Random rather than blocked sets of practice items
   • Training complex stimuli in hopes of affecting simpler stimuli through generalization
   • Providing KR less frequently (50% of the time) and at a delay 3 to 5 seconds (although during pre-practice KP was given on stress, fluency, and loudness for 10 practice stimuli)

5. Nonword multisyllabic stimuli were used to allow for
   — Random ordering of syllables
   — Reducing possible effects of meaning or previous experience
   — Growing evidence that nonwords may promote generalization (Gierut, Morrisey, & Ziemer, 2010)

6. Stimuli varied in complexity and in placement of stress on 1st versus 2nd syllable
   (SW versus WS = Strong-weak vs. Weak-Strong)
   • High – 4 syllable strings composed of 3 diff C and 3 diff Vs
     EX: su/ti/ga
   • Mid – 3 syllable strings with varied C and Vs
     EX: su/ti/ga
   • Low – 3 syllable strings with varied Cs
     EX: su/ti/ga

Integrated Phonological Awareness Intervention
   • Based on phonological awareness interventions developed by Gillon and colleagues for a variety of communication impaired child populations
   • Use with children with undertaken by Moriarty, McNeill, Gillon, and Dodd
**Integrated Phonological Awareness Intervention - 5 studies**

- **Intervention simultaneous targets three areas**
  - Phonological awareness
  - Grapheme to phoneme correspondence (word attack skills)
  - Speech sound production
- **Based on the view that CAS is a multi-level problem** – Drawing on evidence suggesting poor phonological representations → poor speech production → poor phoneme and syllable awareness → persisting challenges in literacy
- **Outcome measures** Phonological process usage and Phonological awareness accuracy

**Nature of phonological awareness intervention** (3-45 min sessions for 3 weeks = about 6.75 hours)

- **Activities**
  - Identification of phonemes in isolation
  - Identification of initial and final phonemes in words
  - Phoneme segmentation and phoneme blending
  - Phoneme manipulation with letter (grapheme) blocks
- **During these “games,” colored blocks (to represent individual sounds) or letter blocks (to represent specific sounds) we used**
- **If sound production error occurred, blocks were used to identify the error and prompt for altered production**

(Lewis et al., 2004; Moriarty et al., 2006; Stackhouse & Snowling, 1992)
What does this intervention look like?

- A group intervention example taken from Gillon (2017)

3 Evidence Based Interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>CAS Severity</th>
<th>Areas Targeted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Temporal &amp; Tactile Cueing (Strand and colleagues)</td>
<td>Moderate to very severe</td>
<td>Movement, Functional word production, Sound production</td>
</tr>
<tr>
<td>Rapid Syllable Transition treatment (Ballard, McCabe, Murray and colleagues)</td>
<td>Mild to moderate</td>
<td>Lexical stress, Sound production</td>
</tr>
<tr>
<td>Integrated Phonological Awareness Approach (Gillon and colleagues)</td>
<td>Moderate to Severe</td>
<td>Phonological awareness, Phoneme-grapheme correspondence, Sound production</td>
</tr>
</tbody>
</table>

Consider these 3 treatments:

- DTTC
- ReST
- Integrated phonological awareness

How might these prove useful to you?
1. Learn to use as a whole package?
2. Ideas you might borrow?
Part 3. Where to look for future interventions

Where to look for more information on interventions?

1. Speechbite

http://speechbite.com/

Where to look for more information on interventions?

2. ASHA Evidence Maps
References


Update on CAS Intervention

Rebecca McCauley, Ph.D., CCC-SLP, BRS-CL
Professor, Department of Speech and Hearing Science
The Ohio State University

Contact Information:
mccauley.90@osu.edu