EVIDENCE-BASED ASSESSMENT AND INTERVENTION PRACTICES FOR CAS

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

OSSPEAC: Ohio School Speech Pathology and Educational Audiology Coalition
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What EBP is not and what it is

What it isn’t

• An all or nothing proposition
• A requirement that each clinical decision be based on a research finding
• A requirement that you need to conduct elaborate searches for non-existent research
• A view that discounts the value of clinical expertise or client involvement in decision-making

What it is

• Encouragement to be explicit with yourself about WHY you make individual assessment and treatment decisions
• Increasing encouragement to search for strong research evidence for decisions that are most important (affect the most children, have the biggest effect on a child)
• An area in which our professional association owes us the greatest possible support to make it feasible

My specific goals for this presentation

1. Argue that a comprehensive approach to assessment and treatment is especially important in CAS
2. Discuss current best options for EB practices in diagnosis of CAS
3. Introduce three key principles of motor learning for speech sound disorders (and especially CAS) to consider during treatment planning,
4. Introduce 3 EB interventions, ones that currently have the best research support (Murray et al., 2014)
   • Two related to speech
   • One related to phonological awareness and speech

Financial Disclosure

The presenter’s financial interests consist of co-authorship of a test to be published in the next year and co-editing of two books that may be referred to in the course of her presentation.
What is CAS and what are its core deficits?

“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)

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)

What additional problem areas have been reported?

- Speech production problems similar to other children 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


Using the WHO ICF system to think about bigger effects

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

ICF and ICF-Youth of the World Health Organization; McLeod & Biele, 2004

Brief review of ICF model

ASSESSMENTS

Principles and Tools with Some Evidence
Basic principle – Be as comprehensive as possible!

Components in a comprehensive assessment

<table>
<thead>
<tr>
<th>Language /Cognition</th>
<th>Speech Phonology to Movement</th>
<th>Functional outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral language</td>
<td>History</td>
<td>Comprehensibility</td>
</tr>
<tr>
<td>- Receptive/expressive</td>
<td>- Speech Sound system</td>
<td>Literacy</td>
</tr>
<tr>
<td>- Semantics/syntax/</td>
<td>description</td>
<td></td>
</tr>
<tr>
<td>- Morphology/pragmatics</td>
<td>- Consistency</td>
<td></td>
</tr>
<tr>
<td>Written language</td>
<td>- Proxody</td>
<td></td>
</tr>
<tr>
<td>- Phonological awareness/</td>
<td>- Motor Speech Exam</td>
<td></td>
</tr>
<tr>
<td>- Reading/writing/spelling</td>
<td>- Structural functional exam</td>
<td></td>
</tr>
<tr>
<td>Other possible domains of interest</td>
<td>- Phonologic inventory</td>
<td></td>
</tr>
<tr>
<td>- Attention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cognition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Speech perception</td>
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</tbody>
</table>

Basic principle – Be as comprehensive as possible!

The problems associated with CAS

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Example</th>
<th>Sources of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core deficit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicative effectiveness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language &amp; communication problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall speech sound problem</td>
<td></td>
<td></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) Vowel errors</td>
<td>8) Syllable segregation</td>
</tr>
<tr>
<td>2) Voicing errors</td>
<td>9) Slow rate</td>
</tr>
<tr>
<td>3) Distorted substitutions</td>
<td>10) Slow diadochokinetic rates</td>
</tr>
<tr>
<td>4) Difficulty achieving initial 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>

Other possibilities of interest

- Attention
- Cognition
- Speech perception

Communicative effectiveness

The problems associated with CAS

<table>
<thead>
<tr>
<th>Characteristic</th>
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</thead>
<tbody>
<tr>
<td>1. Inconsistent errors on Cs and Vs in repeated productions of syllables or words</td>
<td>&quot;teeth&quot; → /tis/ /if/ /taet/ /tæf/</td>
<td>Speech sample Motor speech exam</td>
</tr>
<tr>
<td>- DEAP (Dodd et al.) consistency subtest (3 to 8:11)</td>
<td></td>
<td></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</td>
</tr>
<tr>
<td>- Observations during artic testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Inappropriate prosody, especially in the realization of lexical or phrase stress</td>
<td>Excessive, equal stress</td>
<td>Speech sample Motor speech examination</td>
</tr>
<tr>
<td>- &quot;BUH NUH NUH not 'banana'&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- &quot;TE FO not 'telephone&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Why not an existing standardized motor speech exam?

- Six tests that included motor speech items were examined using operational definitions designed to provide information about the test's
  - Reliability
  - Test-retest reliability
  - Inter-examiner reliability
  - Validity evidence
  - Content
  - Criterion-related
  - Construct

The 6 tests

- Apraxia Profile
- Kaufman Speech Praxis Test
- Oral Speech Mechanism Screening Examination- 3rd edition
- Screening Test for Developmental Apraxia of Speech -2nd edition
- Verbal Motor Production Assessment for Children

Best developed of this group, with some validity evidence, but insufficient reliability evidence

McCauley & Strand, 2008
Still not quite available….the DEMSS: Dynamic Evaluation of Motor Speech Skill

- Reliability and validity evidence (including information about sensitivity and specificity reported in 2013 (Strand, McCauley, Weigand, Stoeckel, & Baas)
- Target date for publication → 2015 by Brookes Publishers

INTERVENTION

(1) Motor learning principles for thinking about how best to organize practice for children with CAS
(2) 3 Best-supported approaches (Murray et al., 2014)

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
- Theories that tie them together – Schema theory

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

The big picture

Communicative effectiveness
Language & communication problems
Overall speech sound problem
Core deficit

(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
- # of trials per session: High dosage = 60 trials/session – 120 trials/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)

(2) Use distributed practice, rather than massed practice sessions—especially initially and especially if problem is severe

- distributed – 10, 10, 10, 10 min
- massed – 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

Sources: Masa, et al., 2006; Murray, 2014; Schmidt, & Lee, 2014; Verdolini, 2000; Wong, Whitehill, Ma, & Masters, 2013

R. McCauley  Evidence-based practices in CAS. OSSPEAC. Columbus, OH.
(3) Initially, use blocked practice then as much as possible random practice

<table>
<thead>
<tr>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>mom, mom, mom, mom, mom</td>
<td>my, my, my, my, my</td>
<td>me, me, me, me, me</td>
</tr>
</tbody>
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Random - multiple targets are intermixed in each block

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Numerous studies show that blocked practice promotes immediate performance. But that random practice promotes longer term learning (= retention and transfer) (5)

(4) Early in learning, provide feedback that is immediate, frequent, and outcome-focused (auditory/kinesthetic/tactile outcomes; not focused on “move this there”)

Why focus on outcomes, not specific routes to success?

- external focus on sensory goals
- internal focus on how to make the movements

Knowledges of results

Knowledge of performance

Why think about incorporating these principles in your clinical problem solving?

- Robust across many groups – normal and 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

(5) BUT later in learning, provide feedback that is still outcome-focused, but less frequent and less immediate

<table>
<thead>
<tr>
<th>Early – week 1-8, before 50% accuracy</th>
<th>Late – after week 6, after 50% accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early – close to 100% &amp; immediate</td>
<td>Late – close to 50% and delayed</td>
</tr>
</tbody>
</table>

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?

- Robust across many groups – normal and adults/children with Apraxia of speech
- They may operate independently of other components of intervention
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Areas targeted by specific treatments with the best evidence

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

The “promise” of EBP is

- Helping us find intervention that work across a wide range of clients so that we can have “go-to” interventions
- Perhaps the best current method for locating such interventions is through systematic reviews of treatment studies.....

- Murray, McCabe and Ballard, 2014
Nature of the Murray et al. study

A systematic review of articles on treatment studies including single subject experimental designs or case series or description studies conducted from 1970 to 2012

- 1,032 possible articles minus those that didn’t really seem to fit the area of interest
- 42 articles with evidence of this kind were found and 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
- Two of the 3 focused on the core problem: Motor planning
  1. DTTC: Dynamic Temporal and Tactile Cueing (Strand & Debertine, 2000)
  2. ReST: Rapid Syllable Transitions (Ballard, 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

* (Rosenbek et al, 1973; Strand & Skinder, 1999; Strand, Stoeckel, & Baas, 2006)

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”]
R. McCauley  Evidence-based practices in CAS. OSSPEAC. Columbus, OH.
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 mild to severe CAS 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 connections between poor phonological representations, poor speech production, poor phoneme and syllable awareness, and persisting challenges in literacy
- Outcome measures: Phonological process usage and Phonological awareness accuracy

Lewis et al., 2004; Moriarty et al., 2006; Stackhouse & Snowling, 1992

Nature of the integrated phonological awareness intervention

(3-45 min sessions for 3 weeks → about 3/4 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

(Moriarty et al., 2006)

3 Evidence Based Interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>CAS Severity</th>
<th>Areas Targeted</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTTC: 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>ReST: 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 accuracy</td>
</tr>
</tbody>
</table>

Summary of today’s talk: Evidence-based practice for CAS

Clinician’s expertise and experience

Expertise – Knowledge

Principles of motor learning

EB Assessments

DEMS Informal Measures

EB Interventions

DTTC ReST Integrated PA

Research evidence

Clinician’s expertise and experience

Client’s preferences, values, and circumstances

(Rasas, et al., 2011; Dollaghan, 2007)