Diagnosing and Treating Children with Childhood Apraxia of Speech in the Presence of Hearing Loss

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Disclosure Statement

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Speaker Disclosure
No relevant financial or non-financial relationships to disclose.

Introduction

Pediatric Hearing Loss

- Newborn Hearing Screenings
  - Identify hearing loss
  - Identify need for further evaluation
  - Identify children “at risk”
  - Establish a plan to monitor hearing status

- Early Hearing Detection and Intervention (EHDI)
  - Hearing screening
  - Hearing aid selection/fitting
  - Entry into Early Intervention (EI)
In 2014, 96.1% of babies in the United States had their hearing tested by 1 month-old, and 6,163 infants were diagnosed with permanent hearing loss. (Centers for Disease Control and Prevention [CDC], 2016).

**Communication Options for Children with Hearing Loss (HL)**

- American Sign Language (ASL)
- Cued Speech
- Total Communication
- Listening in Spoken Language (LSL)

**Main Principles**

- Early detection and diagnosis of hearing loss (HL)
- Optimal hearing through use of assistive listening technology
- Development of the Auditory Feedback Loop (AFL)
  - Say it
  - Hear it
  - Process/Modify it
- Frequent and intense early intervention
  - Parent/family training
Children with Hearing Loss

Challenges

- Clear Hearing
  - Distance
  - Background noise
  - Equipment failure
- Auditory processing time
- Auditory memory
- Auditory discrimination/mishears
- Receptive and expressive language, vocabulary and articulation delays
- Self-advocacy (social/pragmatic language)
- Prosody
- Resonance
**Childhood Apraxia of Speech (CAS):**

- Groping or trial-and-error behavior
- Speech production consistency
- Vowel distortions
- Prosody
- More difficulty with longer words
- Consonant distortions
- Imitation
- Severe speech production and communication delays
- Generalization/carryover
- Functional communication
- Speech perception? (Nijland, 2007)

**CAS & HL Overlapping Features**

- Reduced intelligibility
- Vowel errors
- Consonant omissions/distortions
- Prosodic errors
- Voicing errors
- Imitation difficulties
- Low standardized test scores
- Increased difficulty producing longer words
- Decreased infant babbling
- Phonemic/phonological awareness delays
- "At risk" for developing difficulties with literacy (Gillon & Moriarty, 2007)
- More likely to exhibit fine/gross motor difficulties

**CAS**

- Age-appropriate receptive language and vocabulary skills
- Persistent, pervasive vowel and diphthong distortions
- Significant, pervasive prosodic errors and syllable segmentation
- Sound omissions and/or additions (e.g., intrusive schwa)
- Groping or trial-and-error behavior

**CAS & HL**

- Limited babbling
- Vowel distortions and/or errors
- Prosodic errors
- Omissions of sounds
- Benefit from multisensory cueing

**HL**

- Notable receptive/expressive language, articulation and vocabulary delays
- Vowel errors prior to (1) foundation of AFL, and/or (2) establishing consistent hearing
- Consistent errors with prosody and resonance
- More typical phonological errors
- Occasional trial-and-error behavior for difficult sounds/words
Compare and Contrast: CAS & HL (Continued)

<table>
<thead>
<tr>
<th></th>
<th>CAS</th>
<th>CAS &amp; HL</th>
<th>HL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe difficulties with imitation</td>
<td>Difficulties with imitation</td>
<td>Imitation difficulties given audition only with notable improvement given visuals</td>
<td></td>
</tr>
<tr>
<td>Difficulty with generalization/carryover</td>
<td>Low standardized test scores</td>
<td>Slow, steady speech-language progress</td>
<td></td>
</tr>
<tr>
<td>Inconsistent voicing errors</td>
<td>Voicing errors</td>
<td>Voicing errors prior to (1) foundation of AFL, and/or (2) establishing consistent hearing</td>
<td></td>
</tr>
<tr>
<td>More difficulty producing longer words due to motor planning/programming</td>
<td>More difficulty producing longer words</td>
<td>More difficulty producing longer words due to auditory memory/perception</td>
<td></td>
</tr>
</tbody>
</table>

CAS Assessment
Protocol for Children with Hearing Loss

1. Review medical/hearing history*
2. Observe spontaneous speech
3. Form clinical hypothesis
4. Test hypotheses using carefully selected tasks and measurement tools
5. Support or refute clinical hypothesis
6. Arrive at statement of differential diagnosis
7. Plan therapy

Hearing Loss Considerations
• Child’s hearing loss type/severity
• Child’s current hearing status
• Child’s device wear time
• Child’s Auditory Feedback Loop (AFL)

The features above may lead to:
- Vowel distortions
- Consonant omissions, substitutions or distortions
- Inconsistent voicing errors
- Trial-and-error behavior
- Prosodic errors
- And more...
Dynamic Motor Speech Testing
Assessment Components

• Conversational Speech Sample
• Oral-mechanism examination
• Formal Articulation Assessment
• Informal motor speech assessment (i.e., repeat 1-3 syllable words of different syllable shapes)
• Maximum Performance Task
• Dynamic Evaluation of Motor Speech Skill (DEMSS)
• Childhood Apraxia of Speech (CAS) Clinical Assessments Worksheet (Caspari, 2018)
• Auditory discrimination task (e.g., Compass Test of Auditory Discrimination)

Case Study #1
BB

- 6;0 year-old female
- Attends DePaul School for Hearing & Speech 5 days/week
- Receives 5, 30-minute individual speech sessions per week
- Hearing Technology: Phonak Sky Q50 M13
  - Worn consistently at home/school
- Moderate to profound, bilateral, sensorineural hearing loss with enlarged vestibular aqueducts (EVA)
- New cochlear implant candidate on the left side
- Receives OT/PT services once per week

Video 1
Video 2
Case Study #1: Diagnosis of CAS?

- No.
- Why?
  - Overall, accurate movement gestures for vowels
  - Consistent across repeated trials
  - Consistent consonant errors
  - No prosodic concerns
  - Voicing errors consistent with AFL development
  - Trial-and-error behavior with specific sounds only
  - Benefits significantly from modeling
Case Study #2
JH

- 4/1 year-old female
- Severe, bilateral sensorineural hearing loss
- Received right cochlear implant in March, 2009
- Received right explanation/revision surgery and left cochlear implantation surgery in December, 2009
- Bilateral cochlear implant activation occurred January, 2010
- Wears cochlear implants inconsistently
- Attends DePaul School for Hearing & Speech 5 days/week
- Receives 5, 30-minute individual speech sessions per week
- Receives OT/PT services once per week (sensory needs)
- The following video was taken 20 months post-activation

Assessment Components
Case Study #2 (JH)

- Goldman Fristoe Test of Articulation- 3rd Edition
  - No standard score established
- Dysdiadochokinesis Testing (DDK)
- Informal Motor Speech Assessment
- Childhood Apraxia of Speech (CAS) Clinical Assessments Worksheet (Caspari, 2018)

Case Study #2
JH

Video 1
Case Study #2: Diagnosis of CAS?

- Yes.
- Why?
  - Overt groping/trial-and-error behavior
  - Significant inconsistencies across repeated trials
  - Inconsistent prosodic errors
  - Severe difficulty with imitation
**Intervention: Goals**

Case Study #2 (JH)

- Improve auditory discrimination and auditory memory skills
- Improve overall receptive/expressive vocabulary skills
- Improve overall receptive/expressive language skills
- Improve overall prosodic and suprasegmental development (pitch, loudness, duration)
- Improve movement gestures for speech
- Provide functional means of communication in order to:
  - Reduce frustration
  - Improve social interaction skills

**Therapy Planning: Special Considerations**

Case Study #2 (JH)

- Provide visual supports during auditory tasks
- Establish means of functional communication
- Establish speech sound inventory with parents and family
- Consider speech target stimulability
- Presence in speech sound inventory
- Acoustic energy
- Speech features/prerequisite speech features
- Acoustic context
- Improvement rate
- Frequent and intensive speech therapy incorporating the principles of motor learning
- Multisensory cueing
- Motor-based articulation therapy approach (e.g., dynamic temporal and tactile cueing [DTTC])

**Case Study #2: Update**

Video 2
Current Considerations for Therapy Observations?
- Expressive Language Needs?
- Articulation Needs?
- Prosodic Errors?
- Voicing Errors?
- Current Auditory Feedback Loop Status?

Hearing Therapy Considerations

- LING-6 Sound Test (ah, ee, oo, m, s, sh)
- Use of a Tension Hoop or Speech Hoop during auditory discrimination tasks
- Screening of Auditory Discrimination
  - Screening of Auditory Discrimination Abilities (SADA)
  - Compass Test of Auditory Discrimination
### Supporting Auditory Strategies

**Children with Hearing Loss**

<table>
<thead>
<tr>
<th>Positioning for Optimal Listening</th>
<th>Lowlighting</th>
<th>Checks for Understanding</th>
<th>“What Did You Hear?”</th>
<th>FM/DM Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acoustic Highlighting</td>
<td>The Auditory Sandwich</td>
<td>Processing Time</td>
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### Technology Considerations

- **Daily check**
  - Twice per day is optimal
  - Prior to sessions
  - Upon returning from playgrounds
- Peer/faculty education in schools or day care

**Individuals with Disabilities Education Act (IDEA)**

The school is legally responsible for the maintenance of all technology/devices while a child is in school.

### Special Cases

**Co-occurring Conditions**

- Anxiety
- Attention Deficit Hyperactivity Disorder (ADHD)
- Low tone
- Central auditory processing disorder
- Autism spectrum disorder
- Developmental coordination disorder (DCD)
- Sensory needs
- Fine and gross motor skills
- Cleft and craniofacial anomalies
- Fluency disorders
Conclusion

Review & Call to Action

- Many communication methods exist for children with HL.
- Many overlapping speech sound errors exist between HL and CAS.
- HL alters the diagnostic process and treatment of CAS.
- CAS and HL have many similar co-occurring conditions.
- True prevalence of CAS with HL?