DIAGNOSIS AND INTERVENTION FOR CHILDHOOD DYSARTHRIA

Ruth Stoeckel, PhD, CCC-SLP

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Tacoma, WA

EDUCATION IS THE MOST POWERFUL TOOL WHICH YOU CAN USE TO CHANGE THE WORLD

-- Nelson Mandela

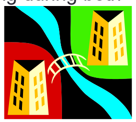
Objectives

- Describe characteristics suggestive of motor speech disorders in young children
- Use best available evidence to determine approaches to treatment
- Describe protocols to evaluate progress in treatment for childhood dysarthria/motor speech disorder

Why Connect Research to Practice?

- Understanding…
  - the physiology of the speech mechanism,
  - interactions of cognitive,linguistic, and motor factors, and
  - effects of treatment factors

informs our clinical decision-making during both assessment and treatment

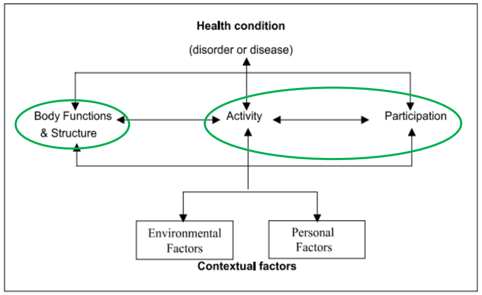


INTRODUCTION

Research to Practice: Evidence Based Practice

- EBP does not require us to use information only from peer-reviewed studies
  - Instead of asking "Is XYZ an evidence-based practice?" ask "What is the level of evidence for this practice?"

WHO – ICF (World Health Organization, 2002)



Body Functions and Structure

- Speech Intelligibility
- Language – grammar and syntax

Determine assessment/treatment approach for THIS child using best available evidence

Elicit information from parents to inform treatment targets

Influence of clinical experience, practice, and data collection practices

Activity and Participation

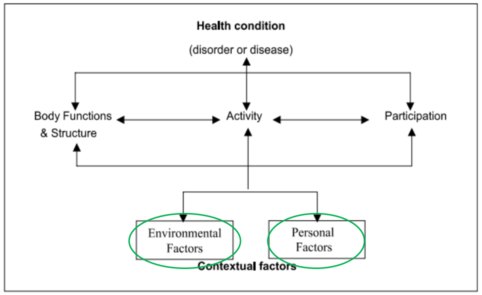
- Able to indicate needs and wants
- Able to relate important information to parents/caregivers
- Able to interact effectively with peers

Include parents/caregivers/community experiences
Based on best available evidence

Elicit information from
Parents about desired activities

Make use of toys/activities already
In the home or inyour toolkit,
seek new materials

WHO – ICF (World Health Organization, 2002)



Research to Practice: Personal

- Throughout the day, be thinking about:
  - **What** information you usually gather during assessment and treatment
  - **Why** you choose specific assessment tools or treatment techniques
  - **How** you use information to arrive at a diagnosis and to guide treatment
  - **When** you modify treatment due to progress or lack of progress

DEFINITIONS AND DEVELOPMENTAL EXPECTATIONS

Dysarthrias

- In adults, dysarthrias are usually differentiated by the site of neurologic damage, the observed impairment of the speech muscles, and the characteristics of speech production
  - Disturbances in strength, speed of movement, range of movement, and timing, which disrupt accuracy

Dysarthrias

- Depending on the type of condition causing the dysarthria, one or more muscle groups may be affected, meaning difficulty with respiration, phonation, resonance, articulation and/or prosody
- The nature and severity of neuromuscular dysfunction can vary across muscle groups within a given individual
  - Children are in a period of physical and neurologic maturation increasing potential variability

Childhood Dysarthria

- Usually associated with other congenital disorders:
  - Craniostenosis
  - Down Syndrome
  - Cerebral Palsy
  - Moebius Syndrome
  - Microcephaly
  - Agenesis of the corpus callosum

(Yorkston, et al, 1999)

Acquired Childhood Dysarthria

- Child develops speech normally; something happens to cause disruption in speech.
  - anoxia or lack of oxygen such as might occur during a near drowning,
  - Closed head injury
  - Degenerative cerebellar disease

Developmental Dysarthria

- Term used when there is no identifiable congenital condition that can explain the presence of dysarthria, nor any injury, disease or illness that has occurred.
- These dysarthrias are usually mild but may be persistent.

Speech Motor Impairment (SMI)

- Term used by Hustad and colleagues to describe young children with characteristics of dysarthria based on their a priori criteria

Let's Talk MOTOR

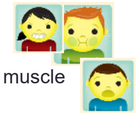
Let's Talk Motor

- Current research suggests that motor development is a complex process that depends on interactions of
  - a child's intrinsic characteristics,
  - their environment,
  - and the culture in which they are raised,
  - not just neural maturation

Let's Talk Motor

- Given documented variability in young children, we should not assume prerequisites for development of skills (e.g., crawling before walking)
  - Development is not a fully predictable, step-wise process across domains

Tone



- Muscle *tone* refers to the degree of muscle contraction or tension at rest
  - Damage to upper motor neuron system is usually related to spasticity, lower motor neuron system to hypotonia
  - Spasticity = excess tension at rest
  - Hypotonia = reduced tension at rest

Tone

- Hypotonia ≠ weakness, although a child with low tone may be weak
- Hypotonia may be seen in structures at rest, but does not always affect movement

Weakness

- Muscle *weakness* occurs when not enough muscle fibers are contracting. May be due to
  - Too few fibers available (muscle atrophy)
  - Disruption of the pathway so the muscle fibers are not activated
  - Inadequate levels of activation

Paralysis/Paresis

- *Paralysis* indicates complete lack of movement due to muscle weakness
- *Paresis* refers to partial limitation of movement due to muscle weakness

Normal Acquisition Oral Motor Skills

- Jaw movement during imitation and reduplicated babble are similar to adults by 12 months
- Upper/lower lip movements become adult-like between ages of 2-6
- There is significant variability among children

(Nip, Green, Marx 2009)

- Tongue strength increases rapidly from age 3-6.5, then more slowly until age 17

(Potter, Nievergelt, VanDam, 2019)

Normal Acquisition Oral Motor Skills

- Control for feeding develops before – and separate from -- the finer-grained movements needed for speech
- EMG data shows differentiation of muscle function for eating and speaking by around 9 months of age (Moore & Ruark, 1996)
- Non-speech movements activate different parts of the brain than speech movements (Bonilha et al., 2006; Ludlow et al., 2008; Schulz et al., 1999; Yee et al., 2007).

The neural basis of motor control is different for non-speech oral movements and speech movements.

Normal Acquisition
Interaction of Multiple Domains

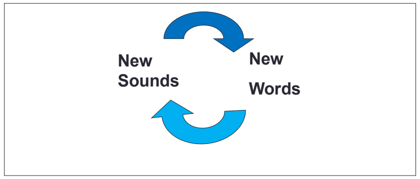
- Nip, Green & Marx (2009) found a strong association between lip and jaw movements and measures of cognition and language
  - Followed children from age 9-21 months
  - The association was maintained even when controlled for age
  - Evidence that there is *interaction* of cognitive, linguistic, and motor development

Normal Acquisition
Interaction of Multiple Domains

- At various points in development, early oral motor skills may limit the rate at which infants and young children acquire new speech sounds

- Conversely, emerging language and cognitive skills may act as a catalyst for slowly emerging speech motor skills (possible initial regression or plateau in articulatory development, but then accelerating growth)

Speech Motor Development and Language Development are ***Interactive***



Early motor speech impairment may result in:

- fewer opportunities to interact with communication partners, resulting in
- fewer opportunities to practice neuromotor speech control, resulting in
- fewer opportunities to practice language forms

Normal Acquisition Speech Motor

- Development of independent motor control of articulators is gradual
  - Grading of movements for producing and sequencing articulatory gestures requires fine motor control
  - Variability in children may be due in part to resource allocation
  - Children with motor speech impairment may have different trajectories for speech motor control

Normal Acquisition Speech Motor

- Variability is not confined to early years
  - Small, McAllister, Grigos (2018) found significant variability among normal speakers age 6-29 in jaw-tongue differentiation
- Weakness can be a “red herring”
  - Potter et al. (2019) found that children with motor speech disorder had less tongue strength than typical children or children with speech disorder, but no correlation with severity of speech impairment

Normal Acquisition
Speech Motor (Kent, 1992)

- Earliest sounds
  - Simple ballistic movments: /p,m,n/
  - Slow "ramp" movements with constant velocity: /w,h/
- Next group
  - Ballistic movments: /b,d,k,g/
  - Ramp movement /j/

Normal Acquisition
Speech Sounds

- Nasals, stops, and glides tend to be acquired first
- Voiced stops are most often heard first in initial position, while voiceless stops tend to be final position
- Fricatives are usually acquired before affricates
  - Affricates tend to be later
  - Affricates are complex combination of fricative and stop

Normal Acquisition
Speech Sounds

- There are some predictable patterns in speech sound acquisition that can be considered in the context of a thorough assessment
- While perceptual and motor constraints are thought to be the primary influence, frequency of sound patterns in the ambient language also play a role in order of mastery

Normal Acquisition Speech Sounds

- The idea of "developmental sequences" of speech sound development is misleading
  - Age of acquisition norms should not be used to make clinical decisions
    - Different studies used different criteria for determining age of acquisition
    - There is a high degree of variability among children in patterns of speech sound acquisition

Get Ready……

The Chart that blew up the internet:

Children's speech sounds

Average age children learn to pronounce English consonants correctly
(Based on 15 English speech acquisition studies compiled by McLeod and Crowe, 2018)

McLeod, S. & Crowe, K. (2018). Children's consonant acquisition in 27 languages: A cross-linguistic review. American Journal of Speech-Language Pathology.

- These are NOT new norms
  - Meta-analysis of existing studies
- Norms tables were never intended to be used for qualifying children for therapy
  - There may be social and educational impact even for "simple artic"
  - Documented concerns for children with SMI

Vowels

- Can be a significant aspect of intelligibility of a syllable
- Are primarily of concern in motor speech disorders (CAS, dysarthria) vs phonological disorders
- Errors are not as likely to spontaneously resolve as consonant errors

Vowels

- Early : /i/, /u/, /o/, /ʌ/,/ɑ/
- Later: /a/, /ɔ/, / ə/
- Later yet: /e ɪ/, / ɪ/, /ɛ/, /ɝ/

(Stoel-Gammon & Herrington, 1990

Vowels (American)
1;3 = /ɪ, ʊ, ʌ, ɑ/
1;6 = /i, u, ʊ, ʌ, ɔ, ɑ, æ/
1;9 = /i,ɪ , u, ɛ, o, ʌ, ɔ, ɑ/
2;0 = /i, ɪ, u, ɛ, e, o, ɔ, ɑ, æ/
(Selby, Robb & Gilbert, 2000)

Based on a limited number of studies, accurate production of vowels and most diphthongs (other than rhotic vowels) appears to be achieved by around age 3

Normal Acquisition Prosody

- By 6-12 months, infants are exhibiting prosodic variations consistent with the ambient language
- Order of acquisition is for falling intonation first, then rising intonation to mark phrase/utterance boundaries
- Comprehension and use of prosody continues to develop through age 10-12

ASSESSMENT

Differential Diagnosis

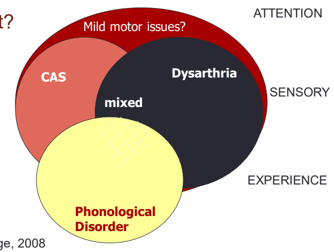
Assessment process for:

1. Classification or label for the speech disorder
2. Determining contribution of cognitive vs. linguistic vs. motor impairment
3. Assistance in planning treatment
   - Identifying most appropriate approach for this child (including AAC)

Classifications may change over time with neural maturation and treatment

Differentiating Severe Childhood Speech Sound Disorders

Simple, right?



Adapted from Hodge, 2008

Ideation	**Communicative intent**	**Cognitive**
Symbolization/ Language	**Word retrieval** **Phonologic Mapping** **Syntactic framing** **Stress assignment**	**Linguistic**
Motor Planning/ Programming	**Specify movement parameters**	**Motor-praxis**
Acoustic Output	**Move muscles** **respiration** **phonation** **resonance** **articulation**	**Motor-execution**

Dysarthria

- Difficulty with **execution of movements**
  - Weakness, paralysis, or abnormal tone resulting in decreased range of motion, decreased speed, or impaired movement of the articulators
  - Usually caused by impairment in the central or peripheral nervous system

- Some children with dysarthria will have no other communication disorder
  - receptive language intact
  - cognitive and social skills within age expectations
- Others will have additional disabilities relating to their neurologic impairment
  - A retrospective study (Hodge, unpublished)
    - 22% normal cognition, 45% borderline, 8% cognitive impairment

Assessment Procedures

- ✓Evidence from the history (speech development, etiology)
- ✓Assess language
- ✓Sound System Assessment: phonetic and phonemic inventories, standardized assessments
- ✓Oral Structural-Functional Examination
- ✓Motor Speech Examination

Assess Language

- Formal measures
  - Receptive/expressive vocabulary
  - General language tests
  - Formal language sample analysis
- Language Sampling can be done with children who have limited intelligibility (Bingner, Ragsdale & Bustos, 2016)
  - Mean Length of Utterance in words
  - Mean number of syllables per utterance
  - Percentage of comprehensible words

Assess Language

- Does the child exhibit communicative intent
- expectations related to language
  - to comment, request, engage in social interaction?
  - to initiate interactions with expected frequency?
- Speech assessment will include consideration of whether speech skills are discrepant from estimates of language

Remember the Interaction

- Children with language impairment often have reduced speech skill
  - It is an influence even for speech motor impairment
- A significant speech problem is often associated with delays in verbal language development.
  - neural resources for formulating and producing an utterance may be constrained by brain injury, genetic limitations, or competition for processing capacity
  - the feedback "loop" of perception and production may be disrupted by limited and/or distorted verbal output

In addition…

- Cognitive function may be a key factor for receptive and expressive language development, as noted in multiple studies of children with CP
  - Severity of lesion may be useful to predict language
  - (Choi, Choi, Park 2016; Hustad)

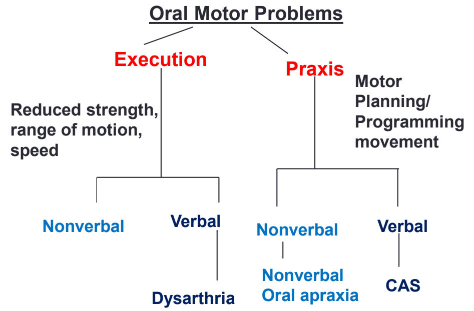
Differential Speech Diagnosis

- There is no published test that is adequate to give a definitive diagnosis of dysarthria

"A significant research challenge is to determine the diagnostic boundaries between CAS and some types of dysarthria with which it may share several speech, prosody, and voice features." ASHA Technical Report, 2007

Diagnostic Indicators: Oral Motor Skills

- With dysarthria, muscle control is generally disrupted for both nonspeech (swallowing, chewing, blowing, etc.) and speech movements



Edythe Strand, 2016

Assessment:
Structure and Function

- Structures
  - Range of motion
  - Coordination
  - Strength
  - Ability to vary muscular tension
  - Speed
- Tissue characteristics

Structural-Functional

- Study: Children with MSD had decreased strength relative to TD and SSD, but….
  - Tongue strength did not correlate to severity of SSD (Potter, et al., 2019)
- Study: Lip muscle force for speaking is only about 10-20% of the maximal capabilities for lip force
  - The jaw uses only about 11-15% of the available amount of force that can be produced (Bunton & Weismer, 1994, Weismer, 2006)

Structural-Functional

- Reduction in range of motion may not be the primary concern for some children with SMI
- Evaluate both precision and range of movement to appropriately individualize treatment

(Allison, Annear, Policicchio, Hustad 2017)

Structural-Functional

- Some individuals with dysphagia have speech problems, but others do not (Ziegler, 2003)
- It is known that we can strengthen the VP mechanism, but nasality is not reduced by this (Kuehn & Moon, 1994)
- Breathing for speech is different than breathing at rest or during other activities (Moore, Caulfield, & Green, 2001)
- See Lof, 2017 for discussion of speech vs nonspeech work

Structural-Functional

- Study: Looked at the task of alternating tongue lateralization to evaluate independent control of tongue and jaw in 39 typical children, adolescents, and adults age 6-29.
- Results: Age did not correlate significantly with contribution of jaw movement to tongue lateralization. Wide variability in jaw movement noted.
- Conclusion: Variability in normal speakers makes it difficult to determine when movements should be considered atypical.

(Small & Grigos, 2019)

Assessment of Physiologic Functioning

- Respiration
- Articulation
- Phonation
- Prosody
- Resonance

Observed in spontaneous output and as part of the motor speech exam

Respiration

Watch for:

- Difficulty initiating phonation
- Reduced loudness/breath support
- Poor regulation of loudness
- Reduced number of words per breath

Articulation

Watch for:

- Limited ability to vary muscular tension (also in CAS)
- Changes in accuracy with increasing length or complexity of utterance
  - Breakdown for CAS = segmenting, reduced vowel accuracy, addition/deletion of syllables
  - Breakdown for dysarthria = rate variability, reduced vowel space, loss of precision

Articulation

Watch for:

- Simplification
- Asymmetrical movement
- Reduced precision and consistency of movements
- Ability to vary rate, prolongation of sounds
- Reduced range of motion

Phonation

Watch for:
- Difficulty initiating phonation (also in CAS)
- Difficulty controlling loudness (also in CAS)
- Reduced loudness/breathy voice
- Reduced pitch or loudness range
- Poorly regulated pitch

Prosody

Watch for:
- Reduced pitch/loudness range
- Poor regulation of breath support for lexical or phrasal stress (expressiveness)

Resonance

Watch for:
- Hypernasal resonance (also in CAS)
- In children who can produce sounds on request, instrumental assessment may help to determine if resonance is related to
  - Structural deficiency or anomaly
  - Weakness
  - Timing

Maximum Performance Tasks (MPT)

- MPD (maximum phonation duration)
  - Average longest production of /a/ and /mama/
- MFD (maximum fricative duration)
  - Average longest production of [f], [s] and [z]
- MRRmono
  - Average fastest (syllables per second) of the fastest [pa…], [ta…], and [ka…]

Maximum Performance Tasks (MPT)

- MRRtri Score
  - Average fastest (syllables per second) /pataka/ (all three syllables must be sequenced accurately 5X within the trial)
- Sequence Score
  - Score 1 if at least one correct repetition of /pataka/; Score 0 if no correct repetition of /pataka/
- Attempts Score
  - Count the number of additional attempts (beyond the first three) that are required for the child to achieve a correct repetition of /pataka/.

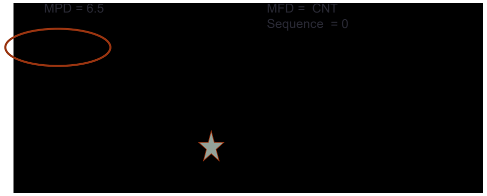
Maximum Performance Tasks (MPT)

MAX Performance Tasks			
	Trial 1	Trial 2	Trial 3
/a/	6	5.5	4
/mama/	7	7.5	6
MPD	6 + 7/2 = 6.5		
/f/			
/s/			
/z/			
MFD			
/pa/			
/ta/			
/ka/			
MRRmono syllables/second			
2.5	3	3	
	Trial 4:	Trial 5:	Trial 6:
MRRtri: (syllables/second)		Sequence (0-none correct) 0	Attempts (additional):

Sample Summary MPT

MRRmono = 3 MRRtri = CNT

[redacted]



Assess Motor Speech Skill

- Assessment should include presentation of targets with hierarchical levels of cuing
  - accommodating a child's developmental level, and
  - using different levels of complexity
    - Sound/syllable movement patterns
    - Syllable sequences
    - Word vs phrase or sentence, and
  - having the child attend to examiner's face for visual cues (Kent, 2004)

Why Use Dynamic Assessment?

- It is sensitive to changes that result from the child's *responses to cues → acquisition of a new skill*
- It is different from standardized tests which compare a child's performance to a normative group
  - Two children with the same standard score on a test may have different levels of severity and different prognosis for change
  - Response to cueing may be more informative about prognosis than total number of errors

Why Use Dynamic Assessment?

- It facilitates judgments of severity and prognosis with the clinician is providing different levels of support or cuing
- Observations regarding response to types and levels of cuing facilitate judgments regarding
  - how much cuing will be needed in early therapy to induce improvement in performance
  - how long it may take to achieve initial progress

Why Use Dynamic Assessment?

- It takes advantage of what a child can do independently while providing support when needed
  - It is interactive, focusing on the process of acquiring a skill
  - The child's responses guide the process, allowing for continuous adaptation
  - It follows the process that can be used in treatment

- We are looking for:
- Estimate of **severity**
- **Where** the breakdown occurs
- **What** type of cueing is needed for success

A good evaluation provides a starting point for treatment planning

Video Example

- https://www.youtube.com/watch?v=WhtuEM9tE-k

Differentiating CAS from other types of speech sound disorders, including dysarthria

Motor Speech Exam

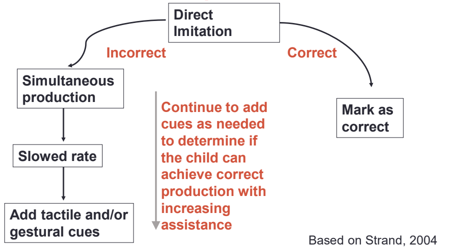
- DEMSS: Dynamic Evaluation of Motor Speech Skills
  - structured assessment to look at praxis/motor planning and programming
  - words of various length, syllable shape, phonetic complexity
  - numeric scores for overall articulatory accuracy, vowel accuracy, prosodic accuracy, consistency

DEMSS: Dynamic Evaluation of Motor Speech Skills

- Criterion referenced
  - Assesses 3/3 most commonly cited characteristics of CAS
  - Does not directly assess for dysarthria, but can elicit behaviors that aid diagnosis

You don't need a commercial test –
you can create your own motor speech exam

Motor Speech Exam



Based on Strand, 2004
and
Strand, et al., 2013

Diagnostic Characteristics

Hodge, M. (2008). Motor Speech Disorders in Pediatric Practice.

Abnormal neuromuscular function that

- disrupts execution of movements
- Is characterized by weakness, slowness, muscle tone abnormalities, reduced movement
- Disrupts coordination and accuracy of muscle groups of the speech mechanism resulting in
  - reduced accuracy and precision of actions/valving of structures for consonant and vowels, and linking these together over time and
  - adversely affects one or more of the speech processes of articulation, resonance, phonation,respiration and prosody

Diagnostic Characteristics

Hustad and colleagues

- Respiration: Short breath groups
- Articulation: Articulatory imprecision
- Phonation: Breathy/harsh voice
- Prosody: Slow rate
- Resonance: Hypernasal resonance
- Visual evidence of abnormal orofacial and/or respiratory movements during speech associated with abnormal tone or weakness

Young Children

Hustad, Allison, McFadd, Riehle (2013)

Studied 27 2-yr-old children with CP. Categorized as

1. Not yet talking
2. Emerging talkers
3. Established talkers

- Significant variability within each group on receptive language
- 85% had clinical speech/language delay relative to age expectations

Verbal Children (Hustad et al.)

- Borderline/mild dysarthria
  - Differ from typically developing children in amount of deviant voice quality and nasality
  - Slower rate in syllables/second
- DYS1 – moderate/severe –
  - mild nasality ratings
  - articulation rate similar to Borderline group
- DYS2 – moderate severe
  - Significantly slower rate than other groups
  - more hypernasal than other groups

Additional Assessment: Speech Perception

- Speech sound *perception* skills may be impaired in some children with speech sound disorders (Munson, Edwards, & Beckman, 2005; Preston, 2007, 2010, 2013)
- Formal tests such as the CTOPP, TOPA, Wepman, etc.
- Informal measures such as the Locke task (1980)

Not easily assessed in young children, but we can proactively provide intentional support for speech perception as part of our intervention

Additional Assessment: Social Skills

- Study of 34 children with CP (mean age 54 months) on PEDI Social Function scores
  - PEDI intended for children age/developmental level less than 7:6
- Greater social function limitations for more severe communication impairment
- Activity-level performance on the PEDI appeared sensitive to language deficits identified in children with SMI plus language impairment.
  - Children with SMI+ LI may have deficits in social function beyond the documented language impairment.

Assessment Summary

- Understanding of normal development is needed to differentiate disordered communication from what disorder or what existed prior to onset of acquired disorders
  - which may have included premorbid delay/disorder
- Even with non-progressive disorders, subsequent motor speech development can be affected

Assessment Summary

Assessment for differential diagnosis should help to determine contribution of cognitive vs. linguistic vs. motor impairment whether or not a formal diagnosis of dysarthria is given

Assessment information should inform intervention planning

assessment can and should be an ongoing process within the context of intervention

INTERVENTION

Intervention: Dysarthria and CAS

Similarities

- Consider cognitive and linguistic needs of the child
  - Functional stimuli
- Incorporate principles of motor learning
- Address nonspeech skills as appropriate (remembering that muscle activation is task-specific)
- Introduce AAC early

Differences

- CAS may be "resolved", dysarthria is chronic
- Principles of motor learning applied to different skills
- Some children with CAS have no impairment of nonspeech skills, all children with dysarthria do

Minimally Verbal Children

(DeThorne, et al., 2009)

- **Provide access to AAC** (see also Schlosser & Wendt, 2008)
- Minimize pressure to speak
- Imitate the child
- Use exaggerated intonation and slowed tempo
- Augment auditory, visual, tactile and proprioceptive feedback
- Avoid emphasis on nonspeech-like articulator movements: focus on function

AAC

- Naturalistic gestures
- Formalized gestures (e.g., ASL, Pidgin Sign, etc.)
- Pictures/picture systems or boards
- Low-tech device (e.g. limited choice SGD)
- High-tech device (e.g. multi-switch/multi-icon SGD)

AAC/Combined Approach

- Combined approach: Natural speech supplemented by AAC strategies (Hustad, Morehouse, Butmann, 2002)
- Using multiple modes depending on partner and context can effectively improve ability to communicate (Hustad & Shapley, 2003)

What Does This Look Like in EI?

Integrated Multimodal Intervention (IMI)

(King, Hengst, & DeThorne, 2013)

- Focuses on simultaneously increasing quantity of meaningful productions of target words and providing supports to shape quality of natural speech by incorporating the full range of a child's communication repertoire, including AAC and natural speech/language

IMI

- Augmented input – Partner accesses AAC with the child
- Target redundancy – targets that are functional in varied contexts
- Naturalistic milieu teaching – (e.g.,cloze, recast, imitation, delay)
- Verbal praise for correct productions
- Correction procedures for speech sounds

What Does This Look Like in EI?

CLEAR vs LOUD

Levy, Younghwa, Ancelle, McAuliffe (2017)

- 8 children age 4-14 with CP, spastic dysarthria
- Word and sentence repetitions using “big mouth” (clear) vs “strong voice” (loud)
- Big mouth more improved over strong voice for single words
- Both cues resulted in improved intelligibility, with variability among children
- Severity of speech and age did not correlate with response to different cues
- Language level may be related, but was not studied

What Do These Look Like in EI?

LSVT LOUD vs “traditional”

Levy, Ramig, Camarata (2012)

- Traditional= posture, discussion of speech clarity, practicing breath support, stress and intensity regulation)
- 3 girls age 3-9
- LSVT LOUD resulted in improved loudness, while traditional therapy did not
- Both treatments resulted in improved intelligibility

What Do These Look Like in EI?

Intensive Therapy
(Pennington, et al., 2013)

15 children age 5-11

3 individual sessions/week for 8 weeks

1. Stabilize respiratory and phonatory effort, control speecch rate and phrase length or syllables/breath.
2. Practice coordination of onset of phonation with beginning of exhalation in sustained vowels, then transfer to speaking
3. Incorporate Principles of Motor Learning

Improvement noted, with wide variation in response to therapy

What Does This Look Like in EI?

PROMPT

- 2 studies, using 6 children with CP, age 3-11
- Improvement in measured movement parameters for target words
- Kinematic measurements suggested changes also in movement parameters in distance, velocity, and duration

What Does This Look Like in EI?

Preschool Intelligibility
DuHadway & Hustad, 2012

- 19 children with CP, 5 TD children age 30-36 months
- Vowel space made the greatest contribution to intelligibility
  - Even children with CP who had intelligibility scores within the range of TD had relatively reduced vowel space

The authors argue the value of early intervention to improve intelligibility and functional communication

Preschool Intelligibility

Hustad, Schueler, Schultz, DuHadway (2012)

- 23 children with CP (NSMI, SMI-LCT, SMI-LCI); 20 TD
  - No Speech Motor Impairment
  - Speech Motor Impairment with typical language comprehension
  - Speech Motor impairment with language comprehension impairment

"Even children with dysarthria who have relatively higher speech intelligibility could benefit from intervention"

Intervention: General

Vowels

- Integrate work into overall treatment plan
  - Work for accuracy, if at all possible
  - Individualize to child – no set order based on evidence in the literature
  - Choose facilitating contexts, remember coarticulation effects
  - Diphthongs involve movement, good to address early if possible

Intervention: General

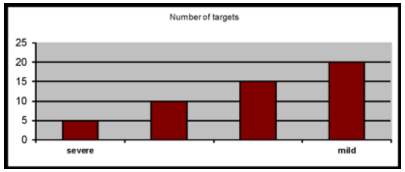
- Intervention targeting timing and coordination rather than articulatory movement may be important for some children (Allison, Annear, Policicchio & Hustad 2017)
- Reducing length and phonetic complexity of utterances may enhance intelligibility (5-yr-olds)
  - But need to consider individual profiles, as relationships between sentence characteristics and intelligibility were variable among children

Summary Chart:

Principle	Acquisition	Retention
Practice Distribution	Mass	Distributed
Practice Variability	Consistent context, consistent prosody, pitch, rate	Varied context, varied prosody, pitch, rate
Practice Schedule	Blocked, predictable order	Random unpredictable order
Feedback Type	Knowledge of performance	Knowledge of results
Feedback Frequency	Often, immediate	Inconsistent, delayed
Rate	Slow	Normal, varied

How Many Targets?

- Depends on severity of child's speech disorder
  - Increase number (and complexity) as skills improve



Type of Targets

- Use what the child has in their inventory and consider:
  - Single syllables vs syllable sequences
  - types of syllables/sequences
  - phonetic complexity
  - awareness of general sequence of sound development (e.g., early, middle, late)
  - string varied syllable shapes (CV, VC, CVC, etc.)

Functional Targets: Consider Speech Needs

Increase sound repertoire
- Try new sounds in existing syllable shapes

Increase syllable repertoire
- Use existing sounds in new syllable shapes
- Phrases as sequences

Improve prosody
- Accurate lexical stress
- Accurate phrasal stress

Functional Targets: Consider Language Needs

Vocabulary
- Nouns
- Verbs
- Conceptual vocabulary

Grammar/ Syntax
- Length of utterances
- Complexity of utterances

Social Interaction
- Greeting
- Requesting/directing
- Commenting

Language

- "Having something to say drives the desire to speak, though speech motor skills must be sufficient for the production (or even approximation) of words"

(Hustad, et al., 2017)

- Children not yet talking at age 2 were very likely to have significant communication challenges at age 4

- When children began to produce single words in imitation, they looked similar at that point in development in terms of intelligibility and MLU regardless of the age at which it occurred

- Children who produced single utterances at earlier ages tended to make faster gains in intelligibility and utterance length
- Intact language comprehension (TACL-3, PLS-4) was associated with best outcomes at age 4 for children who were talking by age 2

Language: model telegraphic utterances or not?

- Using grammatical features may facilitate language processing (Bredin-Oja & Fey, 2014)
  - Helps child anticipate upcoming words
  - Grammatical features (e.g. –ing) help the child learn new words
  - We don't want to reinforce child speaking telegraphically in the long run
  - Typically developing children process spoken language more quickly when grammatically correct than when telegraphic (Fernald & Hurtado, 2006; Fey, Long & Finestack, 2003)

Bilingual Considerations

- Consider the contexts in which a child uses each language and identify vocabulary words that are likely to facilitate carryover, functional use, and repeated practice and exposure in each language.

(ASHA Practice Portal)

EI/Parent Coaching

- Parents are powerful partners
- Participate in sessions (under your direction)
- Home practice activities
  - Do-able activities
  - Brief practice in context of daily routines may generalize more quickly

Eliciting Multiple Repetitions

- Quick reinforcers:
  - ✓ knock down fingers for each trial
  - ✓ earn pieces of a game
  - ✓ token board
  - ✓ turns with a ball
  - ✓ wind up toys
- What tips can you share for eliciting repetitions?

Intervention Review

- Incorporate AAC
- Teach movement sequences vs isolated phonemes
- Teach compensatory articulation and strategies as needed to maximize communication
- Use multisensory input (auditory, visual, tactile)
- Incorporate principles of motor learning

Intervention Review

- Think about range of difficulty in targets (remember that challenge can facilitate motor learning)
- Adjust the level of cueing carefully
- Make thoughtful use of commercial materials
- Collaborate with caregivers

OUTCOMES

Dysarthria Outcomes

- Management may be long term and require periodic re-evaluation of progress and prognosis
- Communication is the main goal → regardless of mode
- Outcomes depend on multiple factors, including cognition, language, and working memory

Dysarthria Outcomes

- There is likely to be chronic motor speech involvement although significant improvements may occur as a result of treatment, development, and/or recovery
  - Some children will be primarily verbal
  - Some children will rely on AAC

Outcomes: Literacy

Peeters et al (2009)

- 52 children with CP, 65 TD
- Children with CP lagged behind TD in all reading precursors
- Word Decoding, Phonological Awareness, Phonological Short Term Memory, Speech Perception, Speech Production, Nonverbal Reasoning
- Speech Production was the most important predictor of early reading success for children with CP
  - Followed by Phonological Awareness and Speech Perception

DOCUMENTING PROGRESS

How do we know our treatment is working?

- Data collection is important
- You should expect to see some changes within a few sessions
- Rate of change may be slow at first
- Be conscious of criteria – it matters!
- Is the child's functional ability to communicate improving?
- Video recordings can be helpful

Probe Testing

- Each target elicited 5-10 trials, depending on
  - Severity
  - Number of targets
  - Child's cooperation
- Choose a context – but keep it the same each time
  - Direct imitation
  - After a delay
  - Spontaneous in answer to a question

Probe Testing -- Scoring

- Binary scoring → right/wrong
  or
- Multidimensional scoring
- YOU make the clinical decision, depending on
  - Ability of caregivers to provide carryover
  - Length of time it took to achieve accuracy
  - Other issues that may affect learning

Probe Testing – Multidimensional scoring

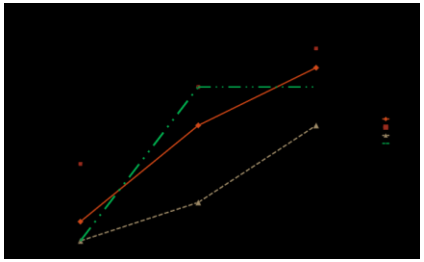
2 = correct production (or accepted variation)

1 = mostly correct, with 1 error on target consonant or vowel production

0 = More than one error of target consonant and/or vowel productions

Sample Data

Sample Data



QUESTIONS?