DYSARTHRIA VS CHILDHOOD APRAXIA OF SPEECH

Diagnostic Markers And Management Strategies

PRESENTER
Ms Devi Jessie Mary
THE PROLOGUE

SPEECH MOTOR CONTROL
SPEECH PRODUCTION MECHANISM
CONCEPTUAL STRUCTURES AND PROCESSES
Speech motor control refers to the systems and strategies that control the production of speech.

Speech requires the integrity and integration of numerous neuro-cognitive, neuromuscular, and musculoskeletal activities.

These activities and the combined processes of speech motor planning, programming and neuromuscular execution are referred to as MOTOR SPEECH PROCESSES.
The Speech Chain

Speaker
- Sensory nerves
- Brain
- Vocal muscles
- Feedback link
- Ear

Listener
- Brain
- Sensory nerves
- Ear

Linguistic level → Physiological level → Acoustic level → Physiological level → Linguistic level
- The **input to the system** of speech motor control is a phonologic representation of language, especially a sequence of abstract units such as phonemes.

- The **output of speech motor control** is a series of articulatory movements that convey the intended linguistic message through an acoustic signal that can be interpreted by a listener.

- The **processes of speech motor control** intervene between those of language formulation and those of the acoustic signal by which the speaker’s message is usually received.
MOTOR SPEECH PROCESSES
THE COMPLEX ACTIVITY OF SPEECH PRODUCTION AND SPEECH PROCESSING

Conceptualization -on

Language Planning

Motor Planning

Motor Programming

Execution

AUDITORY-PERCEPTUAL ENCODING

MEMORY PROCESSES

TRANSCODING PROCESSES

NEUROMOTOR IMPLEMENTATION PROCESSES

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PRODUCTION OF SPOKEN LANGUAGE

- Pre-linguistic aspects
- Discourse regulation
- Language formulation
- Phonologic operations
- Phonetic specifications
- Motor control of the speech production system
PERCEPTION OF SPOKEN LANGUAGE

Comprehension of the spoken message involves operations inverse to those used in its formulation and production.
MOTOR SPEECH DISORDERS

Defined as *speech disorders* resulting from *neurologic impairments* affecting the motor planning, programming, neuromuscular control, or execution of speech.

*(Duffy, 2005)*
CATEGORIZING MOTOR SPEECH DISORDERS

MSDs

Dysarthria

Apraxia
THE COMPLEX ACTIVITY OF SPEECH PRODUCTION AND SPEECH PROCESSING

Consequentialization -on

Language Planning

Motor Planning

Motor Programming

Execution

AUDITORY- PERCEPTUAL ENCODING

MEMORY PROCESSES

TRANSCODING PROCESSES

NEUROMOTOR IMPLEMENTATION PROCESSES
ETIOLOGIES

- CONGENITAL/ACQUIRED
- PROGRESSIVE/NON-PROGRESSIVE
- PATHOLOGIC CONDITIONS
- GENETIC ANOMALIES
- COMORBIDITY
ASSESSMENT GUIDELINES

Motor Speech Examination

(Duffy, 2005)
MOTOR SPEECH EXAMINATION

- History
- Oral Mechanism Examination (during non-speech activities)
- Assessment Of Perceptual Speech Characteristics
- Assessment Of Intelligibility, Comprehensibility And Efficiency.
DYSARTHRIA

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“a collective name for a group of neurologic speech disorders resulting from abnormalities in the strength, speed, range, steadiness, tone or accuracy of movements required for control of the respiratory, phonatory, resonatory, articulatory and prosodic aspects of speech production.

The responsible pathophysiologic disturbances are due to central or peripheral nervous system abnormalities and most often reflect weakness; spasticity; incoordination; involuntary movements; or excessive, reduced or varied muscle tone.”

(Duffy, 2005)
MAJOR TYPES OF DYSARTHRIA
<table>
<thead>
<tr>
<th>DYSARTHRIA TYPE</th>
<th>PRIMARY LESION SITE</th>
<th>NEUROMOTOR BASIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flaccid</td>
<td>Lower motor neuron (final common pathway or motor unit)</td>
<td>Weakness</td>
</tr>
<tr>
<td>Spastic</td>
<td>Upper motor neuron (direct and indirect activation pyramidal pathways)</td>
<td>Spasticity</td>
</tr>
<tr>
<td>Spastic-flaccid</td>
<td>Both upper and lower motor neurons</td>
<td>Mixed</td>
</tr>
<tr>
<td>Ataxic</td>
<td>Cerebellum (Cerebellar control unit)</td>
<td>Incoordination</td>
</tr>
<tr>
<td>Hypokinetict</td>
<td>Basal ganglia, especially substantial nigra (Extrapyramidal)</td>
<td>Rigidity or reduced range of movement</td>
</tr>
<tr>
<td>Hyperkinetic</td>
<td>Basal ganglia, especially putamen, caudate, or both (Extrapyramidal)</td>
<td>Abnormal movements</td>
</tr>
<tr>
<td>U/L Upper Motor Neurone</td>
<td>U/L Upper Motor Neurone</td>
<td>Weakness, Incoordination or spasticity</td>
</tr>
</tbody>
</table>

(Duffy, 2015; Kent et al., 2000)
KEY DIAGNOSTIC MARKERS

Major Clusters Of Deviant Perceptual Dimensions

For Dysarthria
The Dysarthrias have **global**, rather than focal, effects on the speech production systems of respiration, phonation, and articulation and resonance.

They often affect **multiple dimensions of spoken language** and they present with challenges in clinical and scientific description.

(Auzou, Ozsancak, Jan, Leonardon, Menard, Gaillard, Eustache, & Hannequin, 1998; Kent et al., 1998; Kent, Weismer, Kent, Vorperian, & Duffy, 1999; Weismer, 1997; Barlow, 1999; McNeil, 1997)
<table>
<thead>
<tr>
<th>TYPE OF DYSARTHRIA</th>
<th>CLUSTERS OF DEVIANT DIMENSIONS</th>
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</thead>
<tbody>
<tr>
<td><strong>Spastic Dysarthria</strong></td>
<td>§ Articulatory-Resonatory incompetence</td>
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<tr>
<td></td>
<td>§ Prosodic excess</td>
</tr>
<tr>
<td></td>
<td>§ Prosodic insufficiency</td>
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<tr>
<td><strong>Flaccid Dysarthria</strong></td>
<td>§ Phonatory incompetence</td>
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<tr>
<td></td>
<td>§ Resonatory incompetence</td>
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<td></td>
<td>§ Phonatory - Prosodic insufficiency</td>
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<tr>
<td><strong>Spastic-Flaccid Dysarthria</strong></td>
<td>§ Articulatory-Resonatory incompetence</td>
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<td>§ Prosodic excess</td>
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<td></td>
<td>§ Prosodic insufficiency</td>
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<tr>
<td></td>
<td>§ Phonatory stenosis</td>
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<td>§ Phonatory incompetence</td>
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<td>§ Resonatory incompetence</td>
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</tbody>
</table>

*(Duffy, 2005; Darley, Aronson, and Brown [1969a, 1969b]; Kent et al., 2000)*
<table>
<thead>
<tr>
<th>TYPE OF DYSARTHRIA</th>
<th>CLUSTERS OF DEVIANT DIMENSIONS</th>
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<tbody>
<tr>
<td>Ataxic Dysarthria</td>
<td>Articulatory inaccuracy</td>
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<td>Prosodic excess</td>
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<td>Phonatory-prosodic insufficiency</td>
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<td>Hypokinetic Dysarthria</td>
<td>Phonatory incompetence</td>
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<td>Prosodic insufficiency</td>
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<tr>
<td>Hyperkinetic Dysarthria (Chorea)</td>
<td>Articulatory inaccuracy</td>
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<td>Prosodic excess</td>
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<td>Prosodic insufficiency</td>
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<td>Articulatory-resonatory incompetence</td>
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<td>Prosodic excess</td>
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<td></td>
<td>Prosodic insufficiency</td>
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<td></td>
<td>Phonatory stenosis</td>
</tr>
<tr>
<td>Hyperkinetic Dysarthria (Dystonia)</td>
<td>Articulatory inaccuracy</td>
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<td>Prosodic excess</td>
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<td>Prosodic insufficiency</td>
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<td></td>
<td>Phonatory stenosis</td>
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</table>
SPEECH CHARACTERISTICS

❑ Short breath groups (few words per breath)
❑ Abnormal voice quality (strained; breathy) and volume
❑ Difficulty using contrastive stress (equal stress on all words)
❑ Slow rate of speech movements and speaking rate
❑ Nasal resonance and nasal air emission
❑ Imprecise vowels/consonants
❑ Particular difficulty with sounds that require more precise timing (speed) and accuracy
❑ Requires effort to talk

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CO-OCCURRING MARKERS

- Feeding Difficulties
- Dysphagia
- Language Impairment
- Gross and Fine Motor Delays
- Abnormal sensory development/Sensory impairment
- Cognitive impairment

(Crary & Anderson, 1991; Davis et al., 1998; Dewey, Roy, Square-Storer, & Hayden (1988); McCabe et al., 1998; Shriberg et al., 1997; Fiori et al., 2016; Strand, 2003; Forest, 2003; Ferry, 1972; Kumin, 2007)
TREATMENT GUIDELINES
GENERAL TREATMENT

GOALS

(Duffy, 2005)
Goals

- Respiration
- Phonation
- Articulation
- Resonance
- Speech Rate Control
CHILDHOOD APRAXIA OF SPEECH

THE COMPLEXITIES
Childhood Apraxia of Speech (CAS) is a

- **neurological** childhood speech sound disorder,
- in which the **precision** and **consistency of movements** underlying speech are impaired,
- in the **absence of neuromuscular deficits** (e.g. abnormal reflexes, abnormal tone).

The Ad Hoc Committee on Apraxia of Speech in Children, [American Speech and Hearing Organization (ASHA) 2007]
KEY
DIAGNOSTIC MARKERS
NON-VERBAL CHILDREN

- Reduced and/or abnormal babbling pattern
- Inability to imitate speech sound stimuli
- No direct impairment of speech muscles.
- Groping and Posturing difficulties
- *Age appropriate or high receptive language level when compared to verbal language Development.*

(ASHA, 2007a; Forrest, 2003)
VERBAL CHILDREN

- Inconsistent errors on consonants and vowels
- Lengthened and disrupted co-articulatory transitions between sounds and syllables
- Inappropriate prosody
- Increasing difficulty with increased utterance length
- Inconsistent speech articulation
- Poor sequencing of sounds
CO-OCCURRING MARKERS

- Prosodic Problems
- Feeding Difficulties
- Non-verbal Oromotor Apraxia
- Gross and Fine Motor Delays
- Motor Clumsiness; Limb Apraxia
- Abnormal Oro-sensory perception (hyper- or hyposensitivity in the oral area).
- Literacy difficulties

(Crary & Anderson, 1991; Davis et al., 1998; Dewey, Roy, Square-Storer, & Hayden (1988); McCabe et al., 1998; Shriberg et al., 1997, Fiori et al., 2016; Strand, 2003; Forest, 2003; Ferry, 1972; Kumin, 2007)
TREATMENT GUIDELINES
FORWARD MARCH

Establish Baseline

Concentrate on Early V>C or Reverse

Visible > Not Visible Consonants

Phonemes that occur often or most misarticulated

Voiceless before Voiced or Reverse

Associated Problems

Intervention Plan

THINK LOUD!
FORMULATING THE PLAN

- Use Meaningful Speech Stimuli
- Multi-modality Input
- Multiple repetitions – Alternate Movements
- Artic Drilling – Sequential Movements
- Speech Rate
- Speech Intelligibility

Generalization & Self Monitoring Skills
DIFFERENTIAL DIAGNOSIS

APRAXIA vs DYSARTHRIA vs APHASIA
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>DISORDER</th>
<th>APRAXIA</th>
<th>DYSARTHRIA</th>
<th>APHASIA</th>
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<tbody>
<tr>
<td>ORIGIN</td>
<td></td>
<td>Idiopathic/Neurological/Post TBI</td>
<td>Left Hemisphere Lesion in the Extrapyramidal and Pyramidal System</td>
<td>Neurological Lesions</td>
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<tr>
<td>CATEGORY</td>
<td></td>
<td>Motor Speech Disorder</td>
<td>Motor Speech Disorder</td>
<td>Impairment of language</td>
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<tr>
<td>AREA OF DEFICITS</td>
<td></td>
<td>Motor Planning and Motor programming</td>
<td>Motor Programming and Execution</td>
<td>Difficulty understanding or producing language</td>
</tr>
<tr>
<td>MUSCLE TONE &amp; STRENGTH</td>
<td></td>
<td>No weakness, incoordination or paralysis of speech musculature</td>
<td>Decreased strength and coordination of speech musculature that leads to imprecise speech production, slurring and distortions</td>
<td>Co-morbid conditions</td>
</tr>
</tbody>
</table>
APRAXIA vs DYSARTHRIA
Speech Characteristics
<table>
<thead>
<tr>
<th>SPEECH CHARACTERISTICS</th>
<th>DYSARTHRIA</th>
<th>APRAXIA</th>
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</thead>
<tbody>
<tr>
<td>CHARACTERISTICS</td>
<td>Secondary to neuromuscular alterations</td>
<td>Not obvious</td>
</tr>
<tr>
<td>SPEECH COMPONENTS</td>
<td>All systems are affected</td>
<td>Predominantly articulatory and prosodic disorder</td>
</tr>
<tr>
<td>CONSISTENCY OF ERRORS</td>
<td>Generally consistent</td>
<td>Variable</td>
</tr>
<tr>
<td>VOLUNTARY SPEECH</td>
<td>Not affected</td>
<td>Affected</td>
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<tr>
<td>PRODUCTION</td>
<td></td>
<td></td>
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<tr>
<td>ERRORS</td>
<td>Distortions or simplification of speech gestures</td>
<td>Distortions <strong>PLUS</strong> perceived substitutions, additions, repetitions, prolongations or complications of target sound</td>
</tr>
<tr>
<td>DISORDER</td>
<td>DYSARTHRIA</td>
<td>APRAXIA</td>
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<tr>
<td>SPEECH CHARACTERISTICS</td>
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<tr>
<td>ORAL MECHANISM FINDING</td>
<td>Uncommon</td>
<td>Common</td>
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<tr>
<td>Non-verbal oral apraxia</td>
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<tr>
<td>GROPING</td>
<td>Rare</td>
<td>Common</td>
</tr>
<tr>
<td>POSTURING DIFFICULTIES</td>
<td>Rare</td>
<td>Common</td>
</tr>
<tr>
<td>SELF – CORRECTION OF ERRORS</td>
<td>Rare</td>
<td>Common</td>
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</table>
CLINICAL IDENTIFICATION THROUGH INTERVENTIONAL ASSESSMENT
Interventional assessment, i.e. evaluation during therapeutic stimulation will aid in encouraging the child to attempt to communicate verbally in a conducive environment.

This along with diagnosis by exclusion will be the better route to identify the disorder and plan for appropriate treatment.
THE DIAGNOSTIC DECISION TREE
Speech Production Deficit ++

Oro – Motor Incoordination

Yes

Diagnostic Markers CAS

Yes

CAS

No

Oro Motor Weakness

Yes

Dysarthria (?)

No

Phonological processes/patterns

Yes

Articulation Disorder

No

Systematic Speech Errors

Yes

Exit

No

Poor Articulation

Yes

No
MANAGEMENT STRATEGIES

ANALYTICAL TOOLS AND FRAMEWORKS

(Adapted From: Kim And Maubourgne, 2015)
THE 4 ACTIONS FRAMEWORK
THE

“INTERVENTION”

CANVAS
<table>
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<tr>
<th>HIGH</th>
<th>Problem #1</th>
<th>Problem #1</th>
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CASE STUDY #1

A 2.5 year old child was brought with the complaint of difficulty speaking. Parents reported of Normal Motor Milestones, “Silent Baby”; Fussy Eating and worsening temper tantrums.

On Assessment:

- Communication ++ NV
- Receptive Language > Expressive Language
- Difficulty in Imitation ++
- Delayed repetition (perceived spontaneity)
<table>
<thead>
<tr>
<th>Condition</th>
<th>Level</th>
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<tbody>
<tr>
<td>Drooling</td>
<td>Absent</td>
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<tr>
<td>Oro Motor Weakness</td>
<td>Low</td>
</tr>
<tr>
<td>Volitional Speech Affected</td>
<td>High</td>
</tr>
<tr>
<td>Imitation</td>
<td>High</td>
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<tr>
<td>Feeding Difficulties</td>
<td>Low</td>
</tr>
<tr>
<td>Language Delay</td>
<td>High</td>
</tr>
</tbody>
</table>
THE 4 ACTIONS FRAMEWORK

REDUCE
Feeding Difficulties

ELIMINATE
Language Delay

NEW IP

CREATE
Volitional Speech

IMPROVE
Imitation
Devi Jessie Mary - DYSARTHRIA VS CHILDHOOD APRAXIA OF SPEECH

HIGH

LOW

ABSENT

DROOLING

ORO MOTOR WEAKNESS

VOLITIONAL SPEECH AFFECTED

IMITATION

FEEDING DIFFICULTIES

LANGUAGE DELAY
CASE STUDY #2

A 5 year old child with a history of spastic cerebral palsy was referred for focussed intervention. Parents reported of birth distress, negative family history. Reports reveal quadriplegic motor impairment LL>UL, H/O epilepsy, feeding difficulties as well as poor sensory processing.

On Assessment:
- Functional Communication ++ NV>V - Drooling
- Vocalization ++ - Oro-motor difficulty – feeding difficulties
- Delayed Language Development - No signs of dysphagia
<table>
<thead>
<tr>
<th>DROOLING</th>
<th>ORO MOTOR WEAKNESS</th>
<th>COMMUNICATION AFFECTED</th>
<th>IMITATION</th>
<th>FEEDING DIFFICULTIES</th>
<th>LANGUAGE DELAY</th>
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<tr>
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</tbody>
</table>

Devi Jessie Mary - DYSARTHRIA VS CHILDHOOD APRAXIA OF SPEECH
THE 4 ACTIONS FRAMEWORK

- **REDUCE**
  - Oro – motor weakness
  - Drooling

- **ELIMINATE**
  - Language Delay

- **NEW IP**

- **CREATE**
  - Augmented Comm. System

- **IMPROVE**
  - Feeding
HIGH

LOW

ABSENT

DROOLING  ORO MOTOR WEAKNESS  COMMUNICATION AFFECTED  IMITATION  FEEDING DIFFICULTIES  LANGUAGE DELAY

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THE BIGGER PICTURE

Details create the big picture.
Sanford I. Weill
The continuity of babbling and other early vocalizations with phonetic patterns in early speech development points to the use of early vocalizations as a tool to identify infants at risk for communication disorders.

Early identification through Interventional assessment is key to increase positive outcome in the child addressing the early difficulties in motor planning and programming and plays a vital role in differential diagnosis.
IN THEORY, THERE IS NO DIFFERENCE BETWEEN THEORY AND PRACTICE. BUT IN PRACTICE, THERE IS.

Yogi Berra
Using various analytical tools and frameworks to formulate and prioritize the functional goals is most crucial in the developing child.

Selection of intervention approaches that best suit a child’s profile of abilities will form the prognostic markers that aim at better quality of life and well-being.
Innovative Intervention Strategies and/or Adaptive Intervention Strategies should not be neglected by the practicing clinician.

Appropriate documentation will help in supporting and raising the pedestal for working intervention strategies.

Cross-Discipline Collaboration will yield the higher rates of identification as well as most successful results in children exhibits complex co-morbidities.
Many Thanks!