If you are viewing this course as a recorded course after the live webinar, you can use the scroll bar at the bottom of the player window to pause and navigate the course.

This handout is for reference only. It may not include content identical to the PowerPoint. Any links included in the handout are current at the time of the live webinar, but are subject to change and may not be current at a later date.

© 2017 continued® No part of the materials available through the continued.com site may be copied, photocopied, reproduced, translated or reduced to any electronic medium or machine-readable form, in whole or in part, without prior written consent of continued.com, LLC. Any other reproduction in any form without such written permission is prohibited. All materials contained on this site are protected by United States copyright law and may not be reproduced, distributed, transmitted, displayed, published or broadcast without the prior written permission of continued.com, LLC. Users must not access or use for any commercial purposes any part of the site or any services or materials available through the site.
Dysarthria - Back to the Basics: Differential Diagnosis and Assessment

Jessica Huber, PhD, CCC-SLP

Moderated by:
Amy Hansen, MA, CCC-SLP, Managing Editor, SpeechPathology.com

Need assistance or technical support?

- Call 800-242-5183
- Email customerservice@SpeechPathology.com
- Use the Q&A pod
How to earn CEUs

- Must be logged in for full time requirement
- Log in to your account and go to Pending Courses
- Must pass 10-question multiple-choice exam with a score of 80% or higher
  - Within 7 days for live webinar; within 30 days of registration for recorded/text/podcast formats
- Two opportunities to pass the exam

Dysarthria - Back to the Basics: Differential Diagnosis and Assessment

Jessica Huber, PhD, CCC-SLP
Professor of Speech, Language, and Hearing Sciences
Purdue University
Learner Outcomes

As a result of this course, participants will be able to:

1. List and describe how to diagnose five types of dysarthria.
2. Explain how to assess at a variety of levels of the ICF (impairment, activity, participation and environment).
3. Describe how to assess the severity of dysarthria and speech intelligibility.

Definitions

- **Motor Speech Disorder**: “disorders of speech resulting from neurologic impairment affecting the motor programming or neuromuscular execution of speech” (Duffy, 1995, p. 5)
  - Includes dysarthria and apraxia of speech

- **Dysarthria**: a speech disorder resulting from weakness, paralysis, or incoordination of the muscles of the speech mechanism

Prevalence of Motor Speech Disorders

• Large percentage of acquired neurogenic communication disorders are motor speech disorders (50.9%)
  • 36.5% of all acquired disorders are motor speech disorders

Data from Mayo Clinic 1987-1990; taken from Duffy, 1995, p. 8

Team Approach

• Allied Health Personnel
  • SLP, OT, PT, RT
• MD’s
  • Neurologist, Primary Care Physician, ENT, pulmonologist
• Psychologist, Teacher
• Client, Family
Darley, Aronson, & Brown (1969; 1975)

- Studied the classification of six types of dysarthria
  - Flaccid:
    - Neural basis: final common pathway (spinal and cranial nerves) (a.k.a. LMN)
    - Physiology: weakness
  - Spastic:
    - Neural basis: bilateral direct and indirect activation pathways (pyramidal and extrapyramidal systems) (a.k.a. UMN)
    - Physiology: spasticity

Darley, Aronson, & Brown (1969; 1975)

- Ataxic:
  - Neural basis: cerebellum
  - Physiology: incoordination
- Hypokinetic:
  - Neural basis: basal ganglia
  - Physiology: rigidity, reduced range of movement
- Hyperkinetic:
  - Neural basis: basal ganglia
  - Physiology: involuntary movements
- Mixed
Darley, Aronson, & Brown (1969; 1975)

- Two more have been added since the original study
  - **Unilateral UMN**
    - Neural basis: unilateral UMN
    - Physiology: weakness and possibly incoordination
  - **Undetermined**
- These categories may not be as useful in childhood dysarthria

**Distribution of Motor Speech Disorder Types**

Data from Mayo Clinic 1987-1990; taken from Duffy, 1995, p. 13
Why Consider Dysarthria Type?

- Often speech symptoms are the first sign of a neurologic disease
  - Identification of the speech symptoms can assist with medical diagnosis and care
- Can influence treatment decisions
  - For example: You would treat phonatory changes as a result of weakness differently from those that result from incoordination
- However, they are not a perfect fit and do not predict overall impact of the dysarthria on a patient’s life well

Flaccid Dysarthria

- Symptoms vary widely depending on what cranial nerves are involved
- Oral Motor Exam:
  - Weakness and reduced range of motion for articulators
  - Jaw deviates to weak side when opening
  - Tongue deviates to weak side when protruded
  - Drooling
Flaccid Dysarthria

- Articulation:
  - Imprecise articulation

- Resonance
  - Hypernasality
  - Nasal emission

- Prosody
  - Short phrases
  - Monoloudness and monopitch

- Phonation:
  - Breathy voice
  - Audible inspiration

- Commonly associated neurological diagnoses:
  - Brainstem stroke (could lead to locked-in syndrome)
  - Guillain-Barré syndrome
  - Mysathenia Gravis
  - Muscular Dystrophy (Duchenne, Myotonic)
Spastic Dysarthria

- Oral Motor Exam:
  - Pathologic oral reflexes present (suck, snout, and jaw jerk reflexes)
  - Drooling
  - Lability of affect: may fluctuate between laughing and crying for no reason; report that facial expression does not match inner feeling
  - Alternating motion rates (AMR) often slow and reduced in range of motion, but regular in rhythm
  - Impaired movement patterns, but not weakness of specific muscles

- Articulation:
  - Imprecise articulation
  - Distorted vowels

- Resonance
  - Hypernasality

- Prosody
  - Short phrases
  - Monoloudness and monopitch
  - Excess and equal stress and reduced stress
  - Slow speaking rate
Spastic Dysarthria

- Phonation:
  - Low pitch
  - Strained-strangled or harsh voice
  - Pitch breaks

- Commonly associated neurological diagnoses:
  - Bilateral damage to cortical/subcortical regions – due to multiple strokes, TBI, ALS, MS
  - Often a component of mixed dysarthria

Ataxic Dysarthria

- Oral Motor Exam:
  - Irregular speech alternating motion rates (AMR)
  - Strength and symmetry of jaw, lips, face, tongue, and palate are normal at rest

- Articulation:
  - Imprecise consonants
  - Distorted vowels
  - Irregular articulatory breakdowns
Ataxic Dysarthria

- Prosody
  - Excess and equal stress
  - Prolonged phonemes
  - Prolonged intervals
  - Slow rate
  - Monopitch and monoloudness, though some patients have “explosive” loudness

- Phonation:
  - Harsh voice

- Commonly associated neurological diagnoses:
  - Friedreich’s Ataxia
  - Cerebellar Degeneration Disease
  - Often a component of mixed dysarthria
Hypokinetic Dysarthria

- Oral Motor Exam:
  - “Masklike” facial appearance – little, if any, facial expression
  - Reduced RC and AB movement during rest breathing
  - Drooling and infrequent swallowing at rest
  - Tremor of lips and jaw at rest and during movement
  - Rapid and accelerated AMRs
  - Strength in articulators is adequate

- Articulation:
  - Imprecise articulation
    - Spirantization of stops and affricates: Stop gap replaced by low intensity frication
  - Reduced movement of the articulators
  - Variable rate with short rushes of speech
  - Syllable repetitions

- Prosody
  - Monopitch and Monoloudness
  - Reduced stress
  - Short phrases
  - Inappropriate silences
Hypokinetic Dysarthria

- Resonance
  - Hypernasality
- Phonation:
  - Reduced loudness
  - Hoarse, breathy, or harsh voice
  - Tremulous voice
- Commonly associated neurological diagnoses:
  - Parkinson’s disease
  - Can be induced by metal toxicity and the use of some neuroleptic drugs (i.e., Haldol)

Hyperkinetic Dysarthria

- Symptoms vary widely depending on what structures are involved
- Oral Motor Exam:
  - Strength and symmetry are ok
  - Drooling may be present
  - Slow and irregular alternating motion rates (AMR)
- Articulation:
  - Irregular articulatory breakdowns
  - Imprecise consonants
  - Distorted vowels
  - Slow rate
Hyperkinetic Dysarthria

- **Prosody**
  - Inappropriate silences (often waiting for the dyskinesia to pass)
  - Short phrases
  - Prolonged phonemes
  - Prolonged intervals
  - Variable rate
  - Monopitch and monoloudness although some have excess loudness variations and alternating loudness
  - Excess and equal stress and reduced stress

- **Phonation:**
  - Harsh or strained-strangled voice with some transient breathiness
  - Voice stoppages
  - Tremor
  - Audible inspiration
  - Sudden forced inspiration or expiration

- **Resonance:** hypernasality

- Commonly associated neurological diagnoses:
  - Generalized, cervical, and focal cranial dystonias
  - Spasmodic dystonia
  - Huntington’s Chorea
  - Can be induced the use of some neuroleptic drugs (i.e., Haldol)
Mixed Dysarthria in TBI

- More common in the acute phase (60%) and less so over the long-term (10%)
- Characteristics of the dysarthria vary dependent on the site of the lesion. Common mixed components:
  - Spastic-ataxic
  - Flaccid-spastic
- Prosodic difficulties are common
- Often have respiratory involvement
  - Coordination of RC and AB have been shown to be problematic

Mixed Dysarthria in ALS

- Most patients have onset of symptoms in the limbs but up to 30% may have onset in speech
- Generally present with mixed flaccid-spastic dysarthria that may be more flaccid as the disease progresses
- Respiratory muscles weaken, leading to ventilatory-dependency or respiratory failure
  - Median time from diagnosis to ventilatory-dependency was about 35 months in 1 study
  - BIPAP is sometimes used at home to lengthen the time to ventilatory-dependency
Mixed Dysarthria in MS

- Can begin in a variety of ways including visual disturbances, gait problems, sensory issues
- Not all clients exhibit dysarthria, but becomes more common in later stages
  - Mixed dysarthria – ataxic and spastic mostly, but any single or combo is possible
- More common in women
- Much more prevalent in Northern US than southern US (temperate climates)
  - http://library.med.utah.edu/kw/ms/mml/ms_worldmap.html
  - Moving to/from a geographic area before puberty changes risk

Mixed Dysarthria in Progressive Supranuclear Palsy

- Parkinsonian symptoms PLUS
  - Ophthalmoplegia – paralysis of ocular muscles (mainly vertical gaze)
  - Dystonic rigidity of the neck
  - Pseudobulbar palsy
  - Mild dementia
- Disease progresses much more quickly than PD
  - Patients are only expected to live 5-7 years after diagnosis
- Dysarthria can be severe even early on
- Mixed type: spastic, hypokinetic, and ataxic
  - 40% of patients exhibit 2/3 types
  - 60% of patients exhibit all 3 types
Mixed Dysarthria in Multiple System Atrophy

- MSA-C: predominant cerebellar ataxia
- MSA-P: predominant parkinsonism
- Predominant features may change over time and thus the designation may change
- Tend to have mixed dysarthria including hypokinetic, ataxic, and spastic types

ICF Classification: Impairment

- Relates to the functional or structural integrity of the speech subsystems
- Examples: Tongue weakness or reduced vocal fold closure
- Can assess this level objectively with instrumentation
ICF Classification: Activity Limitation

- Problems in the execution of a speech task
- Some problems at this level include reduced intelligibility and abnormal prosody
- Severity of limitations may not be linearly related to the severity of impairments
- Measured perceptually for the most part
- Frequently are the outcome measures for speech therapy
- Often are used to assess severity of the disease

ICF Classification: Participation Restriction

- Involves communication events
  - Encompasses speakers, listeners, context, and purpose of communication exchange
  - Person may be unable to participate in certain communication environments or talk with some potential communication partners and be understood
- Severity of restriction is not always linearly-related to the severity of impairments
- Use checklists and interviewing to assess
ICF Classification: Environmental Factors

- Problems participating in communication due to environmental barriers or due to the biases and attitudes of society or social groups
  - Includes lighting, noise, distance, physical barriers (not wheel-chair accessible)
- No standard way to assess

History

- Similar to other assessments, but be sure to attend to:
  - Course of the disorder and rate of change (improvement or degeneration)
  - Patient’s awareness of disorder and changes to communication
  - Associated problems particularly cognitive, language, and swallowing impairments
Perceptual Assessment

- Considered the “gold standard” for differential diagnosis
  - Evaluation begins usually because the person does not sound “right”
  - Other evaluative methods based on initial perceptual symptoms
  - Include visual and tactile modalities with auditory
  - Often the functional outcome of therapy is improved communicative effectiveness (based in perceptual judgements)

Perceptual Assessment

- Must use connected speech to assess motor function in addition to an oral motor exam
  - Use sentences/imitation, reading passages, conversation
  - Use connected speech to assess perceptual characteristics associated with dysarthria
  - Look for compensations which may improve speech and maladaptive strategies and environmental conditions which may worsen speech
Perceptual Assessment

- Can rate characteristics as normal to severe
- Can use a 5 or 7 point equal-appearing interval scale
  - Often works best for individual speech characteristics (hoarseness or prolonged intervals)
- Can use a visual-analog scale
  - Often works best for overall speech severity or intelligibility

Issues with Perceptual Assessment

- Can be unreliable (inter- and intra-rater reliability is low)
- Cannot be well quantified
- Requires significant training and experience
- Should be coupled with other objective measurements
  - Perceptual ratings can help direct the next level of assessment
Articulation Inventories

- Articulation inventories sample all speech sounds to index what is produced correctly and what errors are made for each sound
- Using articulation inventories allows for
  - Assistance with determining the course of therapy, when to change the tasks, etc
- However, articulation inventories are not used regularly clinically with people with dysarthria

Why Not Use Articulation Inventories?

- Distortions, rather than substitutions and omissions, are the common errors in dysarthria
  - Difficult to hear and transcribe distortions
  - Listeners tend to categorize the sound as the right sound
- SLPs may overestimate the correctness of the phonemes
  - They know what the target phonemes are
  - Are better at identifying sounds from dysarthric speech than the general public
  - Are a familiar listener to the speaker
Oral Mechanism Exam

- Use mostly non-speech activities
- Examine structure
  - Size
  - Symmetry at rest
  - Presence of lesions or growths
  - Mucosal normalcy
- Look for dyskinesias
- Examine range of movement
  - Lack of movement or reduced range of movement
  - Symmetry of range of movement

- Examine strength
  - Symmetry in strength
  - Check using resistance also
  - Coach the patient to work as hard as they can so you measure maximal strength
- Examine rate, coordination, and accuracy of movement
  - Can use speech and nonspeech alternating motion rates
  - Make sure to tell the client to do the task as QUICKLY and as ACCURATELY as they can
    - May need to coach them as you go along
- Examine muscle tone and muscle tension
  - Look at muscle tone at rest and with movement (hypotonic or hypertonic)
  - Ask the patient to contract and relax different muscles to examine ability to modulate tone
Oral Mechanism Exam

- Test for primitive reflexes
- Listen to resonance
  - Can pinch the individual’s nostrils as s/he sustain a vowel
- Test phonation, including pitch range
- Response to Instructions
  - The better the patient is at modulating the behaviors based on instructions, the better the prognosis for improvement with therapy
- Examine sensation
  - Touch, taste, proprioception

Assessment of Phonation

- s/z ratio: not used in in people with dysarthria due to articulatory problems
- Sustained phonation time: not useful in people with dysarthria
  - Don’t use system maximally for speech
  - May be able to modulate vocal fold vibration to get a sustained phonation, but not have good efficiency during speech
Speech Intelligibility

- Measure speech intelligibility
- Measure in connected speech, not single words unless the patient can only produce single words
- Confounded by the fact that familiar listeners will provide a higher intelligibility rating than non-familiar listeners
  - As you provide therapy, you become more familiar, reducing the pre-post test validity of these ratings
  - As an SLP working with the motor speech population, you will be more familiar with dysarthria generally

Speech Intelligibility

- Listener problem:
  - Can have a clinician who is unfamiliar with the speaker rate the speech sample
  - Can have the speaker describe something, tell a story, and later listen and rate yourself
    - But you have context and often experience with the client, especially once treatment has begun
  - Your ratings of intelligibility (familiar with the client or not) may not fit with the complaints of the client or family members
Speech Intelligibility Test

- Computerized test which draws from a large database of words and sentences
- Randomly chooses words and sentences for the patient to produce
- Clinician transcribes what was said
  - Less predictable to the clinician since they do not know what the program will choose to display
- Provides a measure of intelligibility (word and sentence)

Speech Rate

- Perceptual judgments:
  - Most common technique, but has disadvantages:
    - Is not objective so can not quantify changes with therapy
    - Is affected by articulatory precision
    - Inter- and intra-rater reliability is low
- Objective measurements:
  - Measure rate and intelligibility from the same speaking task
    - Measure time to say stimulus (paragraph, conversation, sentence) with stopwatch
    - Count # of words in stimulus
    - Can use an acoustics program to measure articulation time and pause time from the spectrogram
  - Can also measure the number of intelligible words per minute
Acoustic Assessment

- Acoustic measurements are quantifiable
- Can be used as a baseline and an indicator of change across time
- Can confirm perceptual judgments
- Relatively easy to make and equipment is more and more commercially available
- Common measures:
  - Vocal Intensity
  - F0 variability
  - Vowel duration and formant frequencies

Measuring Vocal Intensity

- Need a sound pressure meter and microphone
- Digital read-outs are nice for jotting down numbers as the patient speaks
- Keep mouth-to-microphone distance constant
  - The closer the microphone to the mouth, the better the estimate of sound pressure level since noise has less of an effect
  - Utilize the same mouth-to-microphone distance used in collection of the normative data to which you want to compare
- Ask the patient to talk at their comfortable loudness and pitch
  - Can also check their ability to increase loudness by asking to talk louder
- Note the gain setting on the sound level meter and the mouth-to-microphone distance so if you collect data later, you can be sure you keep those the same
- Take multiple samples in various locations across the speech sample
  - Can jot down samples on a piece of paper and then average them
Acoustic measurements of vowel articulation

- Formant frequencies
- Vowel durations (absolute and relative)
- Vowel space
- Spectral change

Acoustic measurements of consonant articulation

- Segment durations
  - Absolute/relative durations
  - Spirantization of closure intervals
  - Voicing during closure intervals during voiceless stops
- Consonant Spectra
  - Spatial adjustments of vocal tract for consonants helping to signal identity (i.e., “she” vs. “shoe”)
  - Moment coefficients
Physiologic Assessment

- Allows for treatment to be based on the underlying pathophysiology rather than an inference about the pathophysiology
- Can indicate what underlies a symptom
  - Does a certain speech characteristic result from flaccidity?
- Can be used for biofeedback in therapy
- Can be more time-intensive and generally requires specialized equipment and training

Summary

- It is important to consider the type of dysarthria in assessment, but it is not the only characteristic to consider when assessing dysarthria
- While perceptual assessment is vital to diagnosis, objective measurements will help to quantify the impairment and changes with therapy
- It is critical to consider activity limitations, participation, and environment to understand the impact dysarthria in our patients’ lives