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Dysarthria - Back to the Basics: Differential Diagnosis and Assessment

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Dysarthria - Back to the Basics: Differential Diagnosis and Assessment

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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.

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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

Duffy, J.R. (1995). Motor Speech Disorders: Substrates, Differential Diagnosis, and Management. Mosby: St. Louis.

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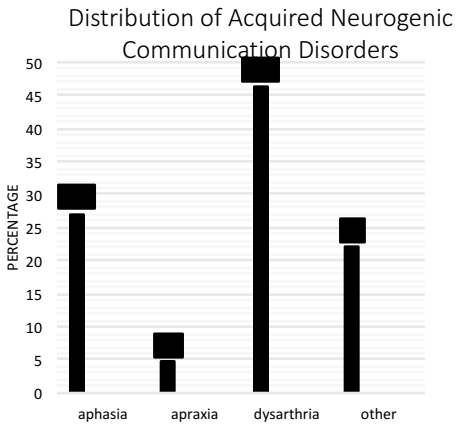
Prevalence of Motor Speech Disorders

- 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

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Team Approach

- Allied Health Personnel
  - SLP, OT, PT, RT
- MD's
  - Neurologist, Primary Care Physician, ENT, pulmonologist
- Psychologist, Teacher
- Client, Family

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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

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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**

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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

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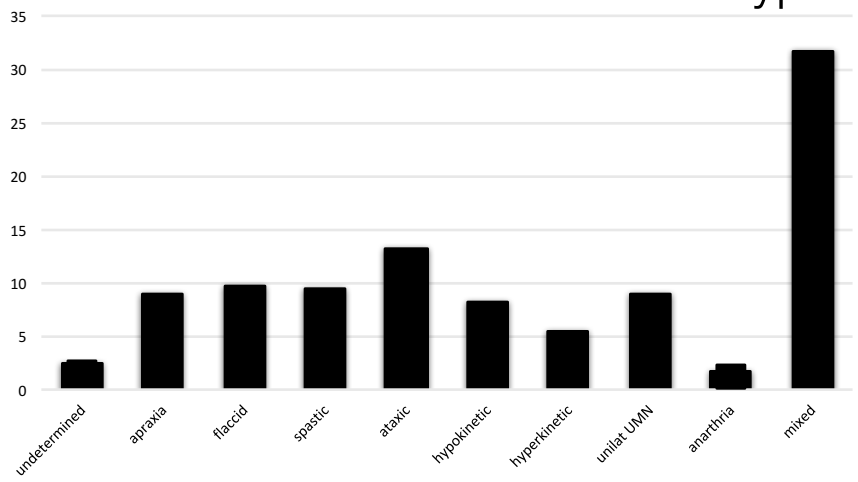
Distribution of Motor Speech Disorder Types



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Data from Mayo Clinic 1987-1990; taken from Duffy, 1995, p. 13

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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

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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

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Flaccid Dysarthria

- Articulation:
  - Imprecise articulation
- Resonance
  - Hypernasality
  - Nasal emission
- Prosody
  - Short phrases
  - Monoloudness and monopitch

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Flaccid Dysarthria

- 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)

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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

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Spastic Dysarthria

- Articulation:
  - Imprecise articulation
  - Distorted vowels
- Resonance
  - Hypernasality
- Prosody
  - Short phrases
  - Monoloudness and monopitch
  - Excess and equal stress and reduced stress
  - Slow speaking rate

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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

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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

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Ataxic Dysarthria

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

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Ataxic Dysarthria

- Phonation:
  - Harsh voice
- Commonly associated neurological diagnoses:
  - Friedreich’s Ataxia
  - Cerebellar Degeneration Disease
  - Often a component of mixed dysarthria

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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

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CONTINUED

Hypokinetic Dysarthria

- 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

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CONTINUED

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)

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CONTINUED

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

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CONTINUED

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

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Hyperkinetic Dysarthria

- 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)

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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

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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

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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

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CONTINUED

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

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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

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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

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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

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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

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CONTINUED

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

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CONTINUED

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

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CONTINUED

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)

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CONTINUED

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

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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

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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

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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

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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

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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

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CONTINUED

Oral Mechanism Exam

- 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

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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

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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

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CONTINUED

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

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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

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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)

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CONTINUED

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

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CONTINUED

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

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CONTINUED

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

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CONTINUED

Acoustic measurements of vowel articulation

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

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CONTINUED

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

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CONTINUED

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

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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

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