Treatment of Dysarthria

Objectives
- Identify treatment targets addressing underlying functional impairments, activity restrictions, and participation limitations
- Incorporate principles of motor learning, including practice and feedback schedules to enhance carry over and retention of acquired skills
- Describe levels of evidence available to support several classes of interventions for dysarthria and identify sources for updates on EBP

Disclosures
- Financial and non-financial conflicts of interest
  - Salary from Mayo Clinic (ask for career opportunities)
  - Book royalties received from Pro-Ed (book topic unrelated to this talk)
  - Grant support
  - National Institute of Neurological Disorders and Stroke
  - National Institute on Deafness and Other Communication Disorders
  - Speaking honoraria
  - ANCDS
  - Certification Board, Professional Affairs Committee
  - SIG 2
  - Coordinator

We need to know what the options are…
And the rationale for selecting among the options
Treatment of Dysarthria

Treatment of Dysarthria
Considering Chronicity

Treatment of Dysarthria: Acute Care
• Goals
  • Identifying or establishing reliable mode of communication
  • Discharge planning
• For prolonged stays
  • On-going assessment as medical status fluctuates
  • May be able to move forward with rehabilitative goals

Treatment of Dysarthria: Early rehabilitation
• Goals
  • Restoration of function
  • Optimizing activity, participation, quality of life
  • Comprehensibility strategies
  • Home and work modifications
  • Conversation partner training

Treatment of Dysarthria: Chronic Phase
• One task is to justify treatment
  • Involves identifying communication difficulties that
    • Have never been treated
    • Have been treated inappropriately
    • Have been treated appropriately but may benefit from a different approach
    • Have been treated optimally but patient and family have not effectively adapted to the “new normal”
  • Much of the highest quality evidence supporting treatment of motor speech disorders is the setting of chronic impairments

Treatment of Dysarthria: Chronic Phase
• Goals
  • Restoration (?), maintenance, and slowed decline, of function
  • Optimizing activity, participation, quality of life
  • Comprehensibility strategies
  • Home and work modifications
  • Conversation partner training

Treatment of Dysarthria: Progressive Conditions
• Goals
  • Restoration (?), maintenance, and slowed decline, of function
  • Optimizing activity, participation, quality of life
  • Comprehensibility strategies
  • Home and work modifications
  • Conversation partner training
Treatment of Dysarthria

Frameworks Guiding Decision Making

ICF

Frameworks Guiding Decision Making

International Classification of Function: ICF

Health Condition

Disorder or disease

- Prognosis
- Predicted comorbidities
- Tolerance for specific modalities

Treatment of motor speech disorders associated with neurodegenerative disease may differ from acute or chronic disease

- Goals
- Time course
- Relatively frequent during establishment of skills or strategies
- Relatively infrequent re-evaluation with updated recommendations

Health Condition

Body Functions and Structures

Activity and Participation

Contextual Factors (Personal and Environmental)

Body Functions and Structures

Underlying impairments of or changes to anatomical structures or physiologic functions

In motor speech disorders, impairments are often described at the level of muscle or nerve impairment (e.g., weakness) or at the level of subsystem (e.g., impairments of voice)

Body Functions and Structures

Activity and Participation

Contextual Factors (Personal and Environmental)

Activity and Participation

Describes the impact of health conditions, impairments, and contextual factors on performance of and participation in functional activities

Body Functions and Structures

Contextual Factors (Personal and Environmental)
Treatment of Dysarthria

Contextual Factors

- Personal factors
  - Age
  - Life experiences
  - Personality
  - Co-morbidities
  - Speakers with dysarthria often have concomitant impairments in speech praxis, language, cognition, and/or swallowing functions.

- Environmental factors
  - Technology
  - Geography
  - Support and relationships
  - Attitudes
  - Services
  - Systems and policies

Application: ICF

- Differential diagnosis
  - Mixed hypokinetic-hyperkinetic-spastic dysarthria
  - Apraxia of speech
  - Cognitive communicative impairment
  - Medical diagnosis
  - Corticobasal syndrome

Application: ICF

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Rationale</th>
</tr>
</thead>
</table>
| Environmental modifications to maximize signal to noise ratio | • Increasing loudness exacerbated phonatory strain
• Cognitive deficits make it difficult for patient to use intentional strategies
• Include strategies addressing reduced output related to cognitive deficits |
| Conversation partner strategies | |

Motor Speech Treatment Hierarchy

Frameworks Guiding Decision Making

Speech Subsystems

- Respiration
- Articulation
- Resonation
- Phonation
- Prosody

Motor Speech Treatment Hierarchy

- The speech subsystems do not act independently
- Adequate respiratory support and velopharyngeal valving supports phonation
- Articulatory precision is supported by respiratory, resonatory, and phonatory competence

Dworkin, 1991
Treatment of Dysarthria

Motor Speech Treatment Hierarchy

- **Third Order Targets**: Articulation, Prosody
- **Second Order Targets**: Phonation
- **First Order Targets**: Respiration, Resonation

Application: Motor Speech Treatment Hierarchy

- **Third Order Targets**: Overarticulation, Loudness (e.g., LSVT)
- **Second Order Targets**: Phonation, Respiration
- **First Order Targets**: Respiratory support (diaphragmatic breathing)

Principles of Motor Learning

- **Measuring Motor Learning**
  - Performance during the treatment session is not a sensitive measure of learning (retention/transfer)

- **To best serve our patients and our profession, we need to diligently report progress/treatment success based on outcomes obtained outside of rehearsal (treatment sessions or at least targeted practice)**

- **Many training factors that enhance learning result in slower acquisition**
  - Random practice
  - Varied practice
  - Reduced feedback

- **The more movement trials the better**

- **All evidence suggests that motor learning is highly specific**
  - Underlying ability cannot be improved by drills targeting speed or coordination
Application: Motor learning

- Treatment targets
  - Loudness
  - Slow rate
  - Over-enunciation
  - Lexical stress
- Skill presentation
  - Direct and indirect modeling
  - "Loud" requires limited verbal description
- Practice
  - Random and variable (assuming the skill has been acquired but not generalized)
- Nonverbal feedback (sound level meter)
- Summary feedback

Read the phrase

- Go for it
- Are you sure?
- The cat’s out of the bag
- Enormous hippopotamus
- I’m in!
- Don’t count your chickens before they’re hatched
- Coffee?

Neuromuscular Functions Thought to Impact Motor Speech

- Strength
- Muscle tone
- Stability and coordination

Neuromuscular Treatment Principles

Frameworks Guiding Decision Making

Strength

- Weakness
  - Maximum force (strength; 1Rmax)
  - Sustained/repeated submaximal force (endurance)
  - Power (near maximal forces at high speed)
- Causes
  - UMN lesion (UUMN and spastic dysarthria)
  - LMN lesion (flaccid dysarthria)
  - Disuse atrophy & deconditioning (all dysarthrias)

Strength Training Principles

- Overload & Progression
- Intensity
- Recovery
- Reversibility
- Specificity of Training
Overload & Progression
- Overload
  - Taxing the muscles beyond typical functioning
  - Results in
    - Hypertrophy of muscle tissue
    - Increased motor unit recruitment
- Progression
  - Systematic overload
  - Implies need for regular reassessment of maximum performance

Intensity
- Strength training
  - 60-80% $1R_{max}$
  - 10 repetitions per set
  - 2-3 sets
- Endurance training
  - 40-60% $1R_{max}$
  - High number of repetitions (e.g., 60)

Recovery
- Optimal interval between training sessions to allow recovery yet avoid reversal
- In large muscle groups, optimal interval is > 24 hrs
- Tongue strengthening studies: 3-7 days/week
- Respiratory muscle strengthening studies: 3-5 days/week

Reversibility
- “Use it or lose it”
- Levels of strength must be used to be maintained

Specificity of Training
- The effects of strength training are highly specific to the trained behaviors
- This is primarily related to motor unit recruitment and motor learning

Motor unit
- Vary
  - Order of recruitment
  - Speed of contraction
  - Force of contraction
  - Resistance to fatigue
- Recruited according to
  - Direction of movement
  - Force and speed of movement
Movement factors subject to specificity
- Force
- Contraction velocity
- Duration
- Dynamics
- Integration

Integration
- Results of motor learning experiments suggest that motor programs (specific patterns of motor unit recruitment) are highly specific
- Predicts that exercises that incorporate the entire movement pattern (e.g., all articulators) will result in greatest carryover

Examining Training Specificity of Lingual Musculature – Competing Hypotheses
- Training Specificity
  - Predicts that greatest gains in strength will be observed for movements that match the exercise
- Muscular Hydrostat (ala Luschei, 1991)
  - Tongue is a muscular hydrostat, with fibers contracting against each other
  - Exercise in any direction will recruit motor units involving most lingual muscle groups
  - Predicts that generalized increases in lingual strength may be observed for untrained lingual movements

Training Specificity Study Direction of Exercise
- Healthy participants
- Performed daily tongue exercise
  - Elevation
  - Protrusion
  - Lateralization

Hypothetical Results

Actual Results
Conclusions

- General training effects may be observed in the lingual musculature
- No given direction of lingual exercise was more effective than another

Exercise Protocol

- 40 healthy adult participants
  - 35 females / 5 males
  - Mean age 23.7 years (range 18 to 59)
- Assigned to one of three training conditions
  - Tongue elevation + ES (N=15)
  - Resistance straw training + ES (N=18)
  - ES only (N=7)
- Daily exercise for 4 weeks
  - 3 sets of 10 repetitions

Lingua-palatal swallowing pressure

- Training x Effort F(1, 37) = 15.2 p = .000
  - Non-effortful Training Effects: F(1,39) = 7.03 p = .029
  - Effortful Training Effects: F(1,39) = 4.73 p = .036
Treatment of Dysarthria

**Negative Pressure Generation**

<table>
<thead>
<tr>
<th>Oral Negative Pressure (kPa)</th>
<th>PreTraining</th>
<th>PostTraining</th>
<th>PreTraining</th>
<th>PostTraining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noneffortful</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effortful</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral Negative Pressure (kPa)</td>
<td>-16.0</td>
<td>-14.0</td>
<td>-12.0</td>
<td>-10.0</td>
</tr>
<tr>
<td>Tongue + ES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straw + ES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ES Only</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Conclusions**

- Training effortful swallow (in isolation or with preparatory contraction) improves only **effortful** swallows.
- Training with high resistance straws improves only **effortful** sips.
- ES and/or tongue exercise did not improved sipping strength.

**Summary of Specificity Research**

- Specificity of training observed for:
  - Strength, endurance and power (intensity of contraction) and dynamics (isometric/isotonic) for lingual elevation
  - Functional orofacial movement patterns
    - Effortful suck
    - Intensity of effort for functional movement patterns
    - Effortful suck
    - Effortful swallow

**Contra-indications for strength training**

- Hypertonia
  - Rationale: High resistance exercise presumed to increase spasticity, arose from principles of the Bobath approach
  - Evidence has failed to support this presumption
    - Stroke (Pak & Patten, 2008)
    - Cerebral palsy (Dood, Taylor & Damiano, 2002; Scholtes et al, 2012)
    - MS (in combination with anti-spasticity medications; Motl, Snook & Hinkle, 2007)
    - ALS (Ashworth, Satkunam, & Dafoge, 2012 Cochrane Review)

- Fatigue Susceptibility
  - Neuromuscular junction deficits: the impairment does not reflect reduced motor unit recruitment nor peripheral muscle weakness.
  - Progressive neuromuscular disease
    - Rationale: resistance exercise induces fatigue without potential benefit of increased strength
    - Evidence
      - Low to moderate intensity exercise may improve functional activity (Kjolhede, Vissing & Dalgas, 2012; White & Dresendorfer, 2004)
      - EMST was effective for ALS patients who tolerated the treatment

**Summary of Specificity Research**

- Specificity of training not observed for:
  - Speed of lingual elevation
  - Direction of lingual movement
  - Overall strength when trained within functional movements
Contra-indications for strength training

- Inflammatory Myopathy
  - Rationale: resistance exercise thought to exacerbate inflammatory response
  - Evidence
    - Case study of lingual exercise in IBM: strength, P-A scores, bolus clearance did not decline over course of 5 year progressive disease
    - No clear evidence for harmful effects of exercise, but insufficient evidence for benefit, either (Voet et al., 2013; Cochrane Review)

- Absence of Weakness
  - This assumption is not under scrutiny (?)

Strength Training in Dysarthria

- Lower level evidence
  - A small number of "low n" controlled studies and/or case studies provide limited support
  - Most authors caution against emphasizing strength training over speech-directed treatment, but acknowledge the potential benefit for specific patients when appropriate principles are incorporated (Dworkin, Linebaugh, Hageman, Duffy, Yorkston, Love, Murdoch)

- Best evidence in support of strength training comes from exercise targeting
  - Respiratory support
  - Phonatory support

  *to be covered later in the presentation

Flaccid dysarthria primarily affecting CN XII, subtle CN VII & X deficits

- Speech features
  - Mild nonspecific hoarseness with occasional fry
  - Imprecise articulation, particularly of lingual consonants

- Non-speech features
  - Lip retraction was full, but lip rounding was mildly reduced
  - Tongue
    - Asymmetric size R>L (subtle)
    - Mild-moderate weakness bilaterally

Flaccid dysarthria associated with myasthenia gravis

- Speech features
  - Reduced loudness
  - Hoarseness
  - Hypernasality
  - Articulatory imprecision
  - Short phrases
  - Rapid fatigue
Strength training: Application
• Are either of these speakers good candidates for strengthening?
• Would strengthening be the only line of therapy?

Disrupted Muscle Tone
Neuromuscular Principles

Muscle Tone Defined
• Resistance of a resting muscle to passive stretch
• Influenced by tissue elasticity and resting motor unit activity

Muscle tone versus muscle strength
• Muscle tone is a characteristic of muscle at rest
• Muscle strength is a characteristic of activated muscle

Muscle Tone Regulation
• Peripheral Reflexes
  • Stretch (muscle spindles)
• Descending pathways
  • Indirect upper motor neuron pathways
  • Basal ganglia control circuit
  • Cerebellar control circuit

Tone Impairments
• Hypotonia
  • Flaccid: diminished signals in reflex arc
  • Cerebellar: mechanism unknown
• Hypertonia
  • Spastic: released inhibition from descending indirect pathway onto gamma motor neurons
  • Rigid: increased excitability of α motor neurons
• Variable Tone
Treatment of Dysarthria

**Muscle Spindle Action in Speech/Swallowing Muscles**

- **Jaw closing muscles**
  - High density muscle spindles
  - Strong stretch reflex
- **Face & lips**
  - Low density or lack of muscle spindles
  - Do not exhibit stretch reflexes

**Muscle Spindle Action in Speech/Swallowing Muscles**

- **Tongue**
  - Muscle spindle density similar to limbs
  - Do not exhibit typical stretch reflexes
  - (Neilson et al., 1979)
- **Palate, Pharynx, Larynx**
  - Presence of muscle spindles varies across muscles
  - No studies to date have demonstrated stretch reflexes in the human larynx (Ludlow, 2005) or pharynx

**Assessment of Muscle Tone: Clinical**

- Passive displacement of relaxed limb
  - Modified Ashworth Scale (6-point scale)
- Muscle palpation
  - Feel for resistance to tissue deformation

**Clinical Assessment of Muscle Tone: Speech musculature**

- Observation of resting position
  - Facial droop
  - Lip retraction
- Orofacial tone assessments
  - Dworkin & Culatta (1996)
  - Beckman (1988)

**Proximal Muscle Groups**

Velum and pharynx

- Slow, symmetrical movements may indicate hypotonia
- Droop, often asymmetrical, may indicate hypotonia

Larynx

- Hypertonicity typically has bias for hyperadduction (strained, strangled vocal quality)

**Evidence for Tone Impairments in Dysarthria**

<table>
<thead>
<tr>
<th>Dysarthria</th>
<th>Hypothesized (Darley, Anson, Brown, 1969)</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flaccid</td>
<td>Flaccid hypotonia</td>
<td>Flaccid: hypotonia (Solomon &amp; Clark, 2010)</td>
</tr>
<tr>
<td>Spastic</td>
<td>Spastic hypertonia</td>
<td>Spastic: No hyperactive stretch reflexes in the tongue in spastic dysarthria (Neilson et al., 1979)</td>
</tr>
<tr>
<td>Ataxic</td>
<td>Normal</td>
<td>None</td>
</tr>
<tr>
<td>Hypokinetic</td>
<td>Rigid hypertonia</td>
<td>Hypokinetic: Increased lip stiffness (Hunker, Abba, &amp; Barlow, 1982; Chu et al., 2010)</td>
</tr>
<tr>
<td>Hyperkinetic</td>
<td>Dystonic/variable</td>
<td>None</td>
</tr>
</tbody>
</table>
Management of Tone Impairments

- Pharmacologic
  - Spasticity
    - Muscle relaxants (e.g., Baclofen)
    - Muscle paralytics (e.g., botulinum toxin)
  - Rigidity
    - Levodopa

- Surgical
  - Spasticity
    - Tendon lengthening
    - Rhizotomy
  - Rigidity
    - Palidotomy
    - Deep brain stimulation

Effects on speech tend to be less dramatic than on postural and limb musculature.

Sensory intervention on orofacial muscle tone:

- Participants
  - 16 women
  - Neurologically normal

- Tissue compliance measures
  - Tested on separate days
  - Before and after
    - Icing
    - Vibration

Submental Compliance Before & After Sensory Intervention

Summary: Submental compliance

- Submental tissue compliance decreased (stiffness increased) after icing but not vibration
- Increased tissue stiffness after icing could derive from
  - Stiffening of non-muscular and muscle tissue
  - Changes in blood flow
  - Increased muscular activity

Muscle tone in the speech musculature: Summary

- Perceptual assessment methods have not been validated with instrumental measures
- Instrumental measures are under exploration but have not yet met validity standards even in the research setting
- Muscle tone in the orofacial muscles is regulated in ways unique from the limb musculature
**Muscle tone in the speech musculature: Summary**

- It is unclear how resting muscle tone affects speech movements.
- Treatments described to address muscle tone in the limbs unlikely to affect speech muscles other than jaw closing muscles.
- No evidence to demonstrate efficacy of tone altering treatments for speech.

**Application: Tone altering therapies**

**Specific Dysarthria Treatments**

**Respiratory Treatments**

**Respiratory Impairments**

- **Impairments**
  - Reduced inspiratory capacity
  - Reduced expiratory pressure
  - Reduced control
    - Checking action
    - Involuntary movements

- **Associated Speech Changes**
  - Reduced overall loudness
  - Loudness decay
  - Excessive loudness variation

**Supporting Respiratory Function**

- **Postural adjustments**
  - Sitting upright or standing typically better than lying supine
- Avoid excess flexion
  - Trunk/abdomen
  - Neck
- External supports
  - Expiratory boards
Inspiratory Muscle Training
- Diaphragm is primary target (belly breathing)
- Discourage excess use of accessory muscles (shoulder breathing)
- Goal is to establish strong, quick inspiration followed by slow, controlled exhalation
  - Early training may incorporate slowed and controlled inhalation and exhalation, discussed on next slide
  - Strength training requires overload, which may be best achieved with an inspiratory training device

Diaphragmatic breathing
- Promotes solid respiratory support
- May help inhibit excessive activation of accessory inspiratory muscles and laryngeal musculature
  - Visual and tactile feedback (“belly breathing”) often helpful
  - Applications on hand-held devices can support independent practice

Controlled Expiration (Inspiratory Checking)
- Can be combined with diaphragmatic breathing
- Focus on quick, strong inhalation
- Followed by slow, steady exhalation

Expiratory Muscle Strength Training (EMST)
- Pressure threshold trainer
- Resistance set at 75% maximum expiratory pressure
- Rule of 5’s
  - 5 repetitions
  - 5 times per day
  - 5 days per week
- 4-8 weeks

Phrase Grouping
- Targets strategic pauses for inhalation
- Phrase length selected according to
  - Respiratory support
  - Syntactic boundaries
Resonatory Treatments

Resonatory Impairments

- Velar weakness
- Slowness of velar elevation
- Reduced control
- Incoordination
- Involuntary movements

Associated Speech Changes

- Hypernasality
- Nasal emission
- Weak articulatory contacts
- Hyponasality
- Alternating resonance

Resonatory Impairments

- Velar weakness
- Slowness of velar elevation
- Reduced control
- Incoordination
- Involuntary movements

Speech-based Resonatory Treatment

- Emphasis of appropriate oral and/or nasal resonance
- May incorporate augmented feedback
  - Nasal mirror
  - SeeScape
  - Nasometry
- May incorporate progressive difficulty
  - Vowels
  - Liquids
  - Plosives and fricatives
  - Phonetic context

Prosthetic Management

- Palatal lift
  - Assessment and implementation in collaboration with prosthodontist
  - Will be most helpful for speakers with isolated hypernasality or nasality disproportionate to other features
  - Keeping in mind that adequate velopharyngeal valving may support the benefit of interventions targeting phonation or articulation
  - Behavioral intervention usually still needed

- Nose plugs
- Nasal obturator
  - Occlude the nares to prevent excess nasal air escape
  - Short term solution while a palatal lift is being fabricated
  - Long term option for patients who are not candidates for palatal lift

Velopharyngeal Exercise

- Nonspeech exercise
  - Examples
    - Horn-blowing
    - Straw-sucking
  - No evidence for carry-over to speech tasks
- Speech exercise
  - Continuous positive airway pressure (CPAP)
  - Overloads the velopharyngeal musculature during speech tasks

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Treatment of Dysarthria

Surgical Management
- Examples
  - Pharyngeal flap
  - Injection augmentation
- Candidacy issues
  - Stable velopharyngeal impairment
  - Patency of airway
- Behavioral intervention may still be needed

Injection Augmentation for VPI

Phonatory treatments

Phonatory Impairments
- Impairments
  - Hypo-adduction
  - Hyper-adduction
  - Reduced flexibility
  - Reduced stability
- Associated Speech Changes
  - Strained voice
  - Breathiness
  - Reduced loudness
  - Monopitch/monoloudness
  - Tremor
  - Flutter

Supporting Phonatory Function
- Hypo-adduction
  - Head turn to facilitate approximation of vocal cords
  - Manual lateralization of the thyroid cartilage
  - Surgical management
    - Vocal cord injection augmentation
    - Thyroplasty
- Hyper-adduction
  - Relaxation
  - Massage

Reducing Laryngeal Strain
- Direct speaker’s attention to somatosensory aspects of excess muscle tension
- Some aspects of laryngeal tension/strain may not respond completely to behavioral approaches
  - Dystonia in hyperkinetic dysarthria
  - Strain-strangled quality in spastic dysarthria – but may overcorrect!
- Excess laryngeal tension may result from poor respiratory support or poor coordination with respiration (see Respiratory Treatments)
**Laryngeal Exercise**

- Increasing medial compression (adduction)
  - Push-pull
  - Grunt
  - Cough
- Increasing pitch range and control
  - Pitch glides and/or steps
  - Pitch matching

**Loudness Treatment**

- Lee Silverman Voice Treatment (LSVT)
  - Systematic hierarchy of exercises, focusing on a single goal "speak LOUD!"
  - Targets respiratory, laryngeal and articulatory subsystems
  - Incorporates high intensity, high frequency practice
  - SPEAK OUT with LOUD Crowd
  - Non-standardized loudness treatment

**Coordinating Respiration & Phonation**

- Potential targets
  - Lung volume at onset of phonation
  - Initiating phonation at the top of inhalation
  - Phrase grouping (ceasing phonation before respiratory support wanes)
  - Rapid inhalation between phrases

**Articulatory treatments**

**Articulatory Impairments**

- Impairments
  - Weakness and/or fatigue
  - Reduced range of motion
  - Reduced speed
  - Reduced coordination
  - Involuntary movements
- Associated Speech Changes
  - Articulatory imprecision
  - Slow rate

**Supporting Articulatory Function**

- Velopharyngeal support (see Resonatory Treatments)
- Jaw support (bite block)
- Sensory tricks (hyperkinetic dysarthria – dystonia)
- Stretching/massage
  - Hyper-reflexia (spasticity) in jaw muscles
  - Would not be expected to facilitate muscle functions in lips, face, tongue
Articulatory Exercise

- Candidates for exercise
  - Detectable weakness is a primary contributor to articulatory imprecision
  - Weakness may be detectable in spastic dysarthria, but slowness of movements may be the greater detriment
  - No contra-indications for resistance exercise (e.g., susceptibility to fatigue)
  - Tongue strengthening programs well studied for dysphagia outcomes, speech evidence is less compelling, even in dysarthria

Articulatory Treatments

- Exaggerated articulation (over-articulation)
- Alternative place/manner/voicing
- Coordination of complex phonetic sequencing
  - Be mindful of task specificity
  - Often targeted in concert with lexical stress (see Prosody treatment)

Prosody Targets

- Speaking rate
- Lexical stress
- Sentential stress
- Phrase groupings (see respiratory treatments)

Speaking Rate

- Even for patients with slow rate, increasing overall speaking rate is almost never an appropriate target
- Reducing speaking rate, even for patients with normal or slow rate, typically improves intelligibility
- Speakers with hypokinetic dysarthria often have rapid rate, but may have difficulty intentionally reducing rate

Rate Reduction Strategies

- Pacing board/hand tapping
- Metronome
Rate Reduction Strategies

- Delayed auditory feedback
- Indirect strategies
  - Increased loudness (see phonatory treatments)
  - “Clear” speech (see intelligibility treatments)

Lexical and Sentential Stress

- Visual cueing/feedback
  - Hand gestures signalling change in loudness, pitch, and/or duration
  - Acoustic software
- Activities/stimuli
  - Contrastive stress
  - Metric pattern across various word lengths
  - Verbal repair

Operational Definitions

Intelligibility

The listener’s success in understanding the acoustic signal produced by a speaker

Comprehensibility

The listener’s success in understanding the message/meaning produced by a speaker

- Both intelligibility and comprehensibility are influenced by the communication environment and the behaviors of the speaker and listener.

- Comprehensibility strategies include behaviors that improve intelligibility

Comprehensibility Strategies

- Seek to improve activity and participation
- Include
  - Optimization of environmental factors
  - Exploiting facilitating personal factors
  - Compensating for limiting personal factors

Helpful resources

Introducing Comprehensibility Strategies

- Initial visit
  - Providing recommendations
  - In order to obtain history

Comprehensibility Strategies

Optimizing the environment
- Speaker behaviors
- Listener behaviors

Reducing background noise
- Obvious, controllable sources
  - TV, radio, computer, etc

- Not-so-obvious controllable sources
  - Appliances
  - Open windows

- Move away
- Take advantage of barriers
Reducing background noise
• Not-so-obvious not-so-controllable sources
  • Road/traffic noise
  • May require other strategies

Optimizing lighting
• Avoid backlighting
• Avoid dim lighting

Optimizing the environment
• Be in the same environment!
  • Avoid communication over a distance

Optimizing the environment
• Reduce distractions
  • Auditory and visual distractions
  • Multi-tasking

Optimizing the environment
• Choose the time and place for communication
  Avoid important conversations when the speaking or listening will be difficult

Speaker Behaviors
Speaker behaviors

- Speech-focused
- Language-focused
- Communication-focused

Speaker behaviors: Speech-focused

- Speak slowly
  - Acknowledge this is challenging
  - Suggest “tricks”
  - Speak loudly
  - Speak clearly

Clinician Pearls

Speaker behaviors: Speech-focused

- Speak very slowly*
  - Pause briefly between each word
  - Pay attention to the small words
  - Do not separate syllables within words
  - Include every syllable
  - Maintain intonation (may have to slow even further)

  *when intelligibility is more dramatically impacted

Speaker behaviors: Speech-focused

- Speak clearly
  - Imagine you’re speaking to someone who is hard of hearing or doesn’t understand your language very well
  - Over-enunciate
  - Speak carefully

Instructions may focus on over-articulation (hyper-articulation), but effects are broader
- Slower rate
- Wider loudness and pitch variation


Speaker behaviors: Language-focused

- Use complete, simple sentences
- Use predictable wording

Speaker behaviors: Speech-focused

- Speak up!
  - Not just for hypokinetic dysarthria
  - Great in the context of reduced background physiologic effort
  - Often improves articulatory precision
  - May reduce rate
Speaker behaviors: Language-focused
• When repeating
  • The first repetition, say it exactly as you said it the first time
  • Rephrase, but make sure the listener knows you’re rephrasing

Speaker behaviors: Communication-focused
• Get the listener’s attention
  • Call his/her name
  • Wait until the listener is watching your face

Speaker behaviors: Communication-focused
• Help the listener predict what you’re going to say
  • Identify the general topic
  • Take advantage of contextual cues (point to objects in the environment, headlines, etc.)
  • Signal topic changes

Speaker behaviors: Communication-focused
• Use all modalities available
  • Speak
  • Point
  • Gesture
  • Facial expression
  • Pictures (points or draw)
  • Write
  • Text
  • Type

Speech Supplementation
• Incorporated during spoken expression
• Strategies provide listeners with additional information to help make sense of the spoken message
• Typically involves “signal-independent” information about the message
• Includes gestures

Alphabet Supplementation
• Point to initial letter of word as each word is spoken
• Also serves as a pacing strategy
• Identification of initial letter facilitates word prediction by listener

Example of alphabet board with vowels aligned on left margin.
Semantic/Topic Supplementation

- Identifies the topic of discussion to help listener’s word prediction and comprehension
- Topics can be identified through
  - Spoken expression
  - Written expression
  - Photographs/pictures
  - Other artifacts
    - Calendars
    - Souvenirs
    - Newspapers

Speaker behaviors: Communication-focused

- Interact
  - Use turn-taking signals
  - Visible
  - Audible
  - Conspirator
  - Let listeners know “the rules”

Listener behaviors

- Give your undivided attention
  - Move close to the speaker
  - Watch the speaker

Listener behaviors

- Know (ask for) the topic
- Watch for topic-changing signals

Listener behaviors

- Piece together the clues
  - Speech
  - Gestures
  - Facial expression
  - Pointing
  - Writing
  - Texting
Listener behaviors
• Signal to the speaker as soon as you don’t understand
  
  A nonverbal signal is often best so the speaker doesn’t feel interrupted

Listener behaviors
• Avoid the least helpful question in the English language
  
  WHAT?

Listener behaviors
• Avoid the least helpful question in the English language
  
  WHAT?

  • Repeat the part of the message you heard
  • Ask yes/no questions for clarification

Listener behaviors
• Know the rules
  
  • How does the speaker signal a turn?
  • Should you “word predict”?
  • What is the back-up plan?

Speaker & Listener Behavior
• Glossing
  
  • Listener repeats each word as the speaker says it
  • Speaker has to pause briefly between words so listener can repeat
  • Correct breakdowns as they occur
  • Combine with alphabet supplementation

Instruction in Comprehensibility Strategies and Developing Recommendations
Presenting Comprehensibility Strategies

- Explain that the goal is successful exchange of information, not word for word intelligibility
- Highlight the value of being understood *the first time*
- Emphasize that successful communication is the responsibility of all participants
- “Good advice for all of us” philosophy

Presenting Comprehensibility Strategies

- Allow speaker and family members to practice and respond
- Troubleshoot obstacles
  - Listeners who “can’t hear”
  - Listeners who only talk
  - “Fast talkers”
- Give feedback and additional guidance

Evaluate success

- Some patients may be proficient after initial session
- Some may need additional instruction
  - Follow-up consultation
  - Component of on-going therapy
- Value of individual strategies may vary across recovery, progression, and/or context

Comprehensibility Strategies

In Context

Acute CVA

- UUMN dysarthria
  - Reduced loudness
  - Nonspecific hoarseness
  - Imprecise articulation
  - Intermittent hypernasality

Considerations

- Right vs Left hemisphere CVA
- Flat affect
- Awareness of deficits
- Concurrent AOS and/or aphasia
- Position restrictions
- Speaker versus listener burden
Chronic conditions
- Identification of maladaptive habits
- Reassurance that functional changes might still be achieved

Progressive conditions
- Identifying “least restrictive” strategies
- Introduce strategies before they are needed
- Regular reassessment to update strategies

AAC
- Augmentative and alternative communication (AAC) is an appropriate option for speakers with poor intelligibility
  - Temporary as speech improves
  - Introduced early in degenerative disease

Evidence-Based Practice Resources
Treatment of Dysarthria

EBP Resources

Find Speech Pathology treatment evidence fast

www.speechbite.com

EBP Resources

- Clinical Aphasiology Conference Proceedings
  - www.clinicalaphasiology.org
  - Proceedings published in AJSLP
- Conference on Motor Speech
  - http://www.madonna.org/res_conferences
  - Proceedings published in AJSLP
- ASHA
  - Special Interest Group 2

Mayo Clinic Locations

Questions & Discussion