Parkinson’s Disease Related Dysphonia:
A Multidisciplinary Approach
Idiopathic Parkinson’s Disease (IPD)

- Progressive neurodegenerative disorder
- Affects approximately 2 million Americans
- Hallmark symptoms
  - Resting tremor
  - Bradykinesia
  - Muscle Rigidity
- >70% with dysphonia; 30% describe as most debilitating deficit (Hartelius, et al 1994)
Pathogenesis of IPD

- Loss of melanin-containing dopaminergic neurons in the substantia nigra
- Dysfunction of basal ganglia
Impact on Laryngeal Function

- Lack of dopaminergic inhibition
- Altered muscular control, increased laryngeal tension
- “Defective” intrinsic musculature
  - Does not improve as much as expected with Dopa therapy (Goberman, et al 2005)
- Characteristic bowing of TVC
- Persistent glottic gap
- Mucosal wave preserved
- Normal vocal process excursion
Characteristics of Phonation in IPD: Perceptual Changes

- Dysarthria-extralaryngeal component
- Decreased variation
- Breathiness
- Increased roughness
- Increased asthenia
- Voice tremor
- Higher mean VHI

Midi, et al 2007
Characteristics of Phonation in IPD: Acoustic Changes

- Maximum phonation time: shorter
- Diadochokinetic rate: slower
- Jitter: higher = more roughness
- Shimmer: higher
- Phonation threshold pressure: increased
- Pitch range: decreased
Correlations between overall severity of IPD and Voice Changes

<table>
<thead>
<tr>
<th>Voice Assessment</th>
<th>UPDRS</th>
<th>Correlation</th>
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</thead>
<tbody>
<tr>
<td>GRBAS</td>
<td>Total UPDRS</td>
<td>None</td>
</tr>
<tr>
<td>VHI</td>
<td>Motor component</td>
<td>+</td>
</tr>
<tr>
<td>TVC Adduction</td>
<td>Rigidity</td>
<td>None</td>
</tr>
<tr>
<td>Laryngeal Tremor</td>
<td>Resting Tremor</td>
<td>+</td>
</tr>
<tr>
<td>PHonation instability</td>
<td>Postural instability</td>
<td>+</td>
</tr>
<tr>
<td>MPT</td>
<td>Rigidity</td>
<td>-</td>
</tr>
<tr>
<td>Speech DDK</td>
<td>Movement DDK</td>
<td>None</td>
</tr>
</tbody>
</table>
MULTI-DISCIPLINARY TREATMENT OF PARKINSON'S-RELATED DYSPHONIA

Speech-Language Pathology Intervention

Presented at Johns Hopkins Voice Center
Greater Baltimore Medical Center
Laryngeal Stroboscopy Grand Rounds
February 14, 2014

Presented by: Donna C. Tippett, MPH, MA, CCC-SLP
February 16, 2014
Hypokinetic Dysarthria in Parkinson’s Disease

• Characteristics
  – Reduced vocal loudness; monoloud
  – Monotone
  – Breathy, hoarse phonation
  – Imprecise articulation
  – Short rushes of speech
  – Dysfluency

Darley et al, 1969, 1975
Hypokinetic Dysarthria in Parkinson’s Disease

• Mechanism
  – Reduced muscle activation
  – Abnormal scaling and maintenance of movement amplitude
  – Sensory processing deficits
  – Internal cueing deficits
  – Impaired self-monitoring and self-regulation

Ramig et al, 2008
Behavioral Therapy for Dysarthria

- **Is**
  - Mainstay of speech-language pathology rehabilitation

- **Can**
  - Improve physiologic function
  - Introduce compensatory strategies

- **Should be**
  - Evidence based
  - Person/patient centered
Lee Silverman Voice Treatment

• Introduced in 1988 by Ramig et al.

• Intensive, high-effort Parkinson-specific tx
  – Trains amplitude (increased vocal loudness), without strain or hyperfunction, as a single motor control parameter
  – Recalibrates motor and sensory system to prevent under-scaling
  – Facilitates compensation via self-regulation

Sapir et al, 2011
Lee Silverman Voice Treatment

• Dosage
  – 4 days/week/4 weeks (16 sessions/month)
  – Minimum 15 repetitions/task
  – 50-60 minute sessions
  – Independent practice

• Focus: LOUD

• Treatment session
  – First half: Daily variables
    • 15 reps MPT in good quality, loud voice
    • 15 reps high pitched /i/
    • 15 reps low pitched /a/
    • 5 reps of 10 functional phrases/sentences using LOUD voice

February 16, 2014
Lee Silverman Voice Treatment

• Dosage
  – 4 days/week/4 weeks (16 sessions/month)
  – Minimum 15 repetitions/task
  – 50-60 minute sessions
  – Independent practice

• Focus: LOUD

• Treatment session
  – Second half: Variable speaking tasks
    • 10 reps of 20 phrases/sentences
    • Increase task complexity from words to conversation
    • Increase duration of speaking task
    • Add distractions, noise, etc
Lee Silverman Voice Treatment

- Evidence based
  - Embodies fundamental principles of exercise physiology
- Person/patient centered
  - Achieves saliency by tailoring speech materials, homework and carryover assignments to individual’s interests, hobbies, communication goals

Theodoros & Ramig, 2011; Sapir et al, 2011
Exercise Physiology Principles

- Goal selection
- Specificity of training
- Overload/progression

Clark, 2003
Goal Selection

• **Strength**
  – Amount of force produced during single bursts or contractions

• **Endurance**
  – Amount of force that can be sustained over longer periods of time

• **Power**
  – Speed at which force is produced

Clark, 2003
LSVT and Goal Selection

• Focus: Strength and endurance
• Addresses intensity
  – 16 sessions/month, 15 reps/task
  – Targets increased vocal loudness, phonation duration
• Addresses task complexity
  – Task hierarchy: words to connected speech
Exercise Physiology Principles

- Goal selection
- Specificity of training
- Overload/progression

Clark, 2003
Specificity of Training

• Muscle response is altered by the particular task used for training
• Muscles should be conditioned during the task that you are trying to improve

Stathopoulous & Duchan, 2006
Specificity of Training

• Transference
  – Rationale for using a nonspecific exercise to improve performance in a related, more specifically defined, functional task

Sapienza & Wheeler, 2006
LSVT and Specificity

- Goal: increased vocal loudness in functional speech tasks, daily communication
  - Transference principle
    - Daily variables
  - Specificity
    - Hierarchy of speech tasks
    - Conversation practice
Exercise Physiology Principles

- Principles
  - Goal selection
  - Specificity of training
  - Overload/progression

Clark, 2003
Overload/Progression

• Muscle should be challenged beyond some threshold level to get the desired conditioning response

Stathopoulos & Duchan, 2006
LSVT and Overload/Progression

- High effort approach
- Maximum sustained phonation
  - Vocal fold adduction
- Highest and lowest pitch drills
  - Flexibility
Person Centered Approach

- Historically, medical model or therapist centered
  - Tasks target specific domains
  - Emphasizes impairment
  - May not translate to functional change

Leach et al, 2010
Person Centered Approach

• Authentic involvement of patients, families, caregivers
• Engaging experiences
• Addresses individual needs, circumstances
• Collaborative process
• Consistent with WHO framework

Leach et al, 2010
World Health Organization Framework

- **Impairment**
  - The abnormality of structure or function at the organ level

- **Disability**
  - The effect that the impairment has had on function, such as reduced ability to speak on the phone or order in a restaurant

- **Handicap**
  - The effect that the disability can have on the ability to participate in social situations, such as being excluded or restricted from an activity in the home or community
Assessment: Disability and Handicap

• What bothers you about your speech/voice?
• When do you have the most difficulty being understood?
• Do you avoid any situations because of your speech/voice?
• How has your speech/voice affected interactions with others?
Assessment: Societal Disadvantage

• Is the patient able to take part in activities in the home, school, job, community?
Treatment Goals

• Go beyond specific modality
• Activity goal
  – Speak in sentences to order in a restaurant
• Participation goal
  – Engage in a parent-teacher conference
LSVT and Saliency

- Incorporates personal interests
- Patient identifies phrases for home practice
LSVT Options

• Videophone
  – Tindall et al, 2008

• Web camera and videoconferencing via Skype
  – Howel et al, 2009

• LSVT LOUD Companion
  – Halpern et al, 2012
IPD and Candidacy for Phonosurgery

- Good vocal fold mobility (normal vocal process excursion)
- Progressive disorder
- Difficulty with cooperation for procedures
- Not candidates for general anesthesia
Surgical Therapy for PRD

Necessary traits of intervention:

- Easily reversible
- Requires little patient cooperation
- Does not interfere with arytenoid movement
- Does not require general anesthetic
Injection Laryngoplasty: Collagen

- N = 35
- Technique: Trans-cartilage or Trans-cricoid; nasopharyngoscopic visualization

Berke, et al 1999
Results

- No major complications
- 75% of subjects: increased satisfaction with voice
  - Based on 5 factor survey (loudness, clarity, social embarrassment, tolerance of injection, overall satisfaction)
- Avg length of benefit: 12 weeks (R: 4-52)
Injection laryngoplasty: Collagen

- N=6
- Transoral injection
- No complications
- 5/6 improved VHI
- Aerodynamic/Acoustic testing
  - Decreased PTP
  - Improved MPT
  - Improved loudness
  - Improved pitch range

2/16/2014 Sewall, et al 2006
Conclusions

- Parkinson’s hypophonia is a complex problem
- IPD patients poor surgical candidates
- Laryngoplastic procedures have no impact on dysarthria/articulation
- Decreasing glottic gap may aid vocal efficiency
- Further studies are required


