Assessment and Treatment of Individuals with Parkinson’s Disease

Assessment and Treatment of Parkinson’s Disease
Jessica E. Huber, Ph.D.
Associate Professor
Purdue University
jhuber@purdue.edu

Background on Parkinson’s Disease

Parkinson’s Disease
-Progressive movement disorder in which there is a deficit in dopamine production in the substantia nigra of the basal ganglia
- Affects about 1.5 million people in the U.S.
- One of the most common degenerative diseases of neurological origin
- Cause is unknown
- Has far reaching effects on the motor and cognitive systems, resulting in speech and language problems

Parkinson’s Disease
- In diagnosis, patient must demonstrate 2/4 classic motor signs: resting tremor, rigidity, akinesia/bradykinesia, or loss of postural reflexes
- Reduction in production of dopamine in the brain
  - Due to death of dopamine producing cells in the basal ganglia (especially the substantia nigra) and the brainstem

Causes of Parkinson’s Disease
Aggregation of α-synuclein and mitochondrial damage are potential causes of neuronal death in PD, including dopamine producing cells

Course of Parkinson’s Disease

Images taken from: Braak et al. (2004); Obeso et al. (2010)
Assessment and Treatment of Individuals with Parkinson’s Disease

Jessica E. Huber, Ph.D., Purdue University
Indiana Speech and Hearing Association Conference, 2013

Progression of Disease

- Subtle neurological features: small, slow movements, soft, monotone voice, tremor
- Non-motor features: olfactory loss, depression, cardiac, visual, gastrointestinal function, REM disorder
- Abnormalities on imaging markers (SPECT): imaging abnormalities precede neural symptoms
- Genetic mutations: high risk for PD; no motor or non-motor features of PD

Affect on Speech Production

- 89% of people with Parkinson’s disease will develop voice problems
- 45% of people with Parkinson’s disease will develop articulation problems
- People with PD sometimes don’t recognize that they have speech problems

PD Affects Respiratory Physiology

- Reduced forced vital capacity and forced expiratory volume in 1 second (De Pandis et al. 2002; Inzelberg et al. 2005; Sabate et al. 1996; Seccombe et al. 2011; Weiner et al. 2002)
- Reduced inspiratory and expiratory strength (Haas, Trew, and Castle 2004; Inzelberg et al. 2005; Sabate et al. 1996; Seccombe et al. 2011)
- Impairments in the control of breathing may be present as well (Seccombe et al. 2011)
- Impairments worsen with disease progression (Haas, Trew, and Castle 2004; Polati et al. 2001; Sabate et al. 1996)

Cough Strength is Affected by PD

- Pitts, Bolster, Rosenbek, Troche, and Sapienza (2008) found that patients with PD who had swallowing difficulties demonstrated changes to cough dynamics, including:
  - Longer compression phase duration
  - Slower expiratory rise time
  - Decreased expiratory peak airflow
  - Decreased cough volume acceleration
  - All of these changes are likely to result in reduced clearance of penetration and aspiration
Assessment and Treatment of Individuals with Parkinson’s Disease

**Hypophonia**

- Sound pressure level (SPL) is the physical correlate of loudness
- Some individuals with PD have a lower SPL
- **Impact:** Communication partners are hearing impaired, exponentially increasing the effect on communication

Data from Darling and Huber (2011)

**Monotone Voice**

- Fundamental frequency (F0): physical correlate of pitch
- Reduced F0 range and variability
- Reduced marking of stressed words or focus of sentences

Data from Holmes, Oates, Phyland, and Hughes (2000)

**Changes to Speech Rate with Disease Progression**

- Shorter utterances
- Faster speech rate
- **Impact:** Harder for listeners to distinguish sounds and words, less time to comprehend incoming speech

Data from Huber and Darling (in prep)

**PD: Self-Perception**

- May not perceive their speech and voice problems as severely as their communication partners
- Individuals with PD have difficulty accurately perceiving their own loudness
- Do not perceive speech errors as accurately as control subjects
- **Impact:** Therapy is difficult because we need to teach them that their speech is impaired

**Cueing**

- External cues: visual or auditory feedback to perform a task
- Internal cues: unconscious information or self-cueing guides task performance
- Improvements in gait patterns have been shown in response to both external and internal cues
  - Internal cues did not generalize as well as external ones
- Similar findings for handwriting and speech as in gait
Assessment and Treatment of Individuals with Parkinson’s Disease

Cueing

- Some cues work better than other cues for achieving a specific goal
- Most speech therapy for people with PD aims to improve loudness or rate
- Impact: The cues used in therapy will affect the outcome

Sadagopan and Huber (2007)

Aspects of Communication Difficulties

- Yorkston and colleagues:
  - Communication is different
  - Need to accept that they can’t communicate the way they used to
  - Participation in life changes as a result of the communication difficulties
  - Limited by many factors – hearing problems, visual disturbances, memory loss, in addition to speech and language difficulties
  - Communication is unpredictable
  - Problems are variable – different on different days
  - Different people treat you differently
  - Old strategies for communicating fail as the disease changes

Balance Problems in PD

- 50-70% of individuals with PD have fallen
- Many of these individuals suffer debilitating injuries from their fall, drastically reducing their overall mobility
- Even when a serious injury is not sustained, individuals with PD often lose confidence in their own balance and have a large fear of falling
- Such a fear causes these patients to limit their daily activities and therefore negatively affects their overall quality of life

Additional difficulties in PD

Cognitive Changes in PD

- May be present in subtle ways before diagnosis is made
- Dopaminergic cell loss begins 4-6 years before onset of motor symptoms and diagnosis is based on motor symptoms
- Cognitive deficits are seen at first diagnosis, and do not progress as rapidly as motor symptoms post diagnosis
- May be markers of early premotor PD
- Later disease these non-motor symptoms can be the major factor affecting quality of life

Deficits in visuospatial skills, memory, language, attention, mood, and emotional processing

Problems developing their own plan of action or initiating and maintaining goal-directed behavior, along with concept formation and self-monitoring behavior

Problems with dual tasking and prioritization of secondary tasks
- This may play a role in falls in individuals with PD
Assessment of Respiration

In Research, Assessment Involves Instrumentation
- Typical assessment involves obtaining:
  - Maximum expiratory pressure with a meter
  - Lung capacity with a spirometer
  - Respiratory patterns with a Respitrace
  - Pause durations with a microphone and acoustic software
- We often do not have access to these kinds of instruments in our clinical sites

Utterance Length: Indicator of Respiratory Impairment
- Breath group: all of the words said on one breath
- Can have a patient read a paragraph and watch for breaths
- Mark the breaths on the paragraph
- Count the number of syllables/breath group

Norms for Utterance Length
- Hoit & Hixon (1987) – Tables 7 and 10 list number of syllables per breath group for reading and extemporaneous speech in young, middle-aged, and older men
- Hoit et al. (1986) – Tables 6 and 9 list number of syllables per breath group for reading and extemporaneous speech in young, middle-aged, and older women
- Huber et al. (2012) – Table 2 shows the number of syllables during reading in young and older adults and individuals with PD
- Huber (2008) – Figure 3 shows the number of syllables and speech rate for four different utterance length groupings during extemporaneous speech (comfortable and loud) in young and older adults

Respiratory Patterns Without Instrumentation
- You can watch the chest wall or place your hands on the chest wall
- Look for the following:
  - Excessive movement of the shoulders or chest wall
  - Is speech produced at lung volumes above end expiratory level EEL for the most part?
  - Do they breathe in before speaking?

Breath Pausing: Indicator of Respiratory Function
- Young adults generally take breaths at major syntactic locations
- Hammen and Yorkston (1994) found individuals with dysarthria (various types and causes) took a significant number of breath pauses at syntactically unimportant locations
- Why are they important?
  - Listeners use breath pauses to parse running speech into syntactic units
  - Taking breath pauses at unimportant syntactic locations makes speech less comprehensible
  - Can be particularly important when coupled with a degraded speech signal, as in Parkinson’s disease

Grosjean & Collins, 1979; Hammen & Yorkston, 1994; Shah et al., 2006; Winkworth et al., 1994
Example Sentences

- "Devoted to his family, especially his children, **SEC** Papa worked night and day to provide for us. **MAJ** Although we never showed Papa our appreciation **MIN** on a daily basis, I know that **UNR** he felt our love, or so **UNR** I hope."

Assessment of Breath and Non-Breath Pauses

- Watch for pauses without inspiration (for emphasis)
  - Lack of these kinds of pauses suggests reduced respiratory support

- Determine where inhalations occur – syntactic appropriateness of locations
  - Look for inappropriate pauses or silences
  - Reduces intelligibility and speech naturalness; may make it difficult for them to hold their turn

Norms for Breath Pausing

- Huber et al. (2012) in AJSLP – Table 2 shows the breath pausing relative to punctuation and syntax during reading in young and older adults and individuals with PD
  - The reading passage, with syntactical categories, is included in the appendix

Respiratory Muscle Without Instrumentation

- Can assess during non-speech using scales:
  - Hixon & Hoit (1998, 1999, and 2000) have published scales for assessing the function of the respiratory muscles (diaphragm, rib cage, and abdomen) using speech and nonspeech tasks
  - Observe the movement of the RC and AB to determine functioning of the muscles
  - Each paper describes the tasks, the indications of abnormal function for each task, and include a record form for doing the assessment

Treatment

PD: Medical Treatment

- Medical Treatment is usually pharmacological
  - L-dopa crosses blood-brain barrier to produce dopamine in the brain
  - Does not remEDIATE speech symptoms well

- Deep Brain Stimulation is a common surgical treatment for later-stage patients
  - Helps tremor very much
  - Is often detrimental to speech, swallowing, and cognition
Lee Silverman Treatment Program

- Lee Silverman Treatment Program (LSVT® LOUD)
- Intensive, 1 hour per day, 5 days per week, for 4 weeks
- Clinician instructs the patient to talk more loudly, to use high effort
- Clinician will work to help the patient with PD perceive their new louder voice as normal for them
- Practice 10 functional phrases the person uses in everyday life which are used to cue the person to talk louder everyday, outside of therapy
- Daily home practice is required

LSVT® LOUD

- There is a large body of literature to support its use
- Improvements in voice and articulation and in intelligibility when the patients speak more loudly
- The effects can last 6 months to a year without additional therapy for some patients

- LSVT® LOUD has limitations however
- Generalization to everyday activities is difficult for some patients
- Large body of literature has shown that external cues are more effective than internal ones for individuals with Parkinson’s disease
- Because Parkinson’s disease affects cognitive function, it is difficult for individuals with PD to remember to talk more loudly
- May not be appropriate for individuals who fatigue and may not be able to handle the intensive nature of the therapy
- Many people live too far from a trained, certified clinician

Expiratory Muscle Strength Training

- Set to 70% of the patient’s maximum expiratory pressure or the highest level the patient can tolerate
- Patient completes:
  - 5 breaths through the device, 5 times per day
  - 5 days per week
  - For 4-5 weeks
- Device setting is increased as the patient improves

EMST Improves Cough Dynamics

- Device is set to elicit 3-5 dB increase in SPL
- Patient wears the device each day (2-8 hours) during communicative situations
- Reads aloud for 30 min five days/week
- Device is reset as patient improves

SpeechVive

- Pitts, Bolster, Rosenbek, Troche, Okun, and Sapienza (2009), n = 10
Assessment and Treatment of Individuals with Parkinson’s Disease

Subject Characteristics

- H&Y Stage II-IV with predominantly III-IV (moderate to severe motor impairments)
- Mild-severe speech impairments, with predominantly moderate-severe impairment pre-training
- Mean time since diagnosis was 10 years (SD = 6 years)
- All patients except one on Levodopa medication
- Tested at the same time within medication cycle
- 16 of the patients had prior speech therapy (11 had LSVT LOUD)
- Overall mild to moderate hearing loss
- 5 patients with Deep-Brain Stimulator (DBS) implants
  - DBS is often detrimental to speech, swallowing, and cognition

Sample Comments from patients about the SpeechVive™

- People no longer spoke over me like I wasn’t there
- I got more respect from people because I could talk better
- It was a reminder to speak louder
- My wife said I pronounced words better, more clearly
- My kids thought I had a good voice after using the device

Example Effect of SpeechVive™

- Patient with Parkinson’s disease
  - Comfortable and then with the SpeechVive™
  - Patient’s first time using the SpeechVive™
  - Is currently on medication for PD and uses a deep-brain stimulator

Treatment Take Home Message

- PD affects respiratory physiology and respiratory support for speech
- You can obtain indirect evidence of respiratory impairments in PD
- Several treatments can improve speech in people with PD
- There are some treatments which have demonstrated effectiveness by studying the respiratory system directly
  - EMST
  - SpeechVive
- EMST affects cough, swallow, and speech which gives you multiple benefits from one treatment

Treatment for Communication Difficulties: Optimizing Communication Effectiveness

- Hearing problems – hearing aid
- Therapy for speech, language, and cognitive difficulties
  - Can include therapy to reduce impairment
  - Often includes training to compensate for the difficulties
  - Can also include prosthetic management

Strategies for Improving Communication in Individuals with Dysarthria

Yorkston, Beukelman, Strand, and Hakel (2010). Management of Motor Speech Disorders in Children and Adults
Speaker-Managed Strategies

- Prepare your partner
  - Let the listener know you are about to speak
- Set the topic
  - Identify the topic prior to speaking
    - Verbally, with gestures, using a communication board (choosing a pre-printed category, spelling out the topic)
    - Be sure also to indicate any topic changes

- Use grammar
  - Use complete sentences if possible
- Listeners can use the syntax to assist with decoding the sentence
  - Use simple sentence structure

- Use gestures
  - Use natural gestures and movements
- Use turn maintenance signals
  - Indicate that you want to begin a turn and maintain a turn
  - Instruct listeners on what the signals mean

- Plan the timing of communication
  - Plan important communication for when you are least tired and the listener is least distracted
- Select a conducive environment
  - Choose quiet places to converse
  - Choose places where speaker and listener can see each other

Listener-Managed Strategies

- Maintain topic identity
  - Periodically check that the speaker and listener are still on the same topic
- Pay attention to the speaker
  - Concentrate on listening to and looking at the speaker

- Piece together clues
  - Take the parts of the message that you understand and try to put them together to understand the entire message
  - If facilitators (familiar listeners) are used, be sure that the boundaries have been established with the speaker
Co-Managed Strategies

- Manage communication breakdowns
- The speaker should encourage the listener to indicate right away if they do not understand since the breakdown will be easier to repair that way
- The speaker can also pause occasionally to allow the listener to indicate comprehension or ask if the listener understands

Co-Managed Strategies

- When there is a breakdown in communication,
  - The speaker can begin by repeating the message
  - If this does not work with 2-3 reps, try something else
  - Rephrase the message
  - Describe the items you are talking about or the ideas
  - May be helpful to have a strategy for repairing communication agreed upon between the speaker and listener
  - Listener can periodically summarize their understanding thus far in the conversation

Co-Managed Strategies

- Establish interaction rules
- Have agreed upon interaction cues (initiation and maintenance of turns, confusion, repetitions, etc.).

Strategies to Help Individuals Communicate

- Shifting communication modes
  - Using something other than speech and primary mode of communication
  - Use all modes as needed (writing, gesture, alphabet supplementation, spelling)
  - May want to consider using other modes in noisy environments and when the message is less “guessable” (past events, abstract topics)

Alphabet Supplementation

- Speaker points to the first letter of each word as they say it
- Provides grapheme cues
- Also slows rate of speech
- Speaker must be able to speak minimally, identify the correct first letter, and select the letter from the board (point, light, eye-gaze)

Strategies to Help Individuals Communicate

- Providing context for communication
- Can supplement speech with “remnant books” and photo albums
- Remnants are things like ticket stubs, programs, menus, etc.
- The speaker can use them as a list of topics
- Photographs can be sequenced to assist with telling about an event or to explain how to do something
Alternative to Behavioral Therapy

- Voice Amplification System
- Portable microphone/speaker system which is used to amplify the speaker's voice
- Example: Chattervox

http://www.chattervox.com/