Learning Objectives

- Identify and describe the hallmarks of the SLP voice evaluation of patients with vocal fold paralysis
- Define steps to assess stimulability for change and candidacy for voice therapy
- Explain rationale and decision making for choosing voice therapy techniques for patients with a vocal fold paralysis

Overview

- Nomenclature
- Evaluation and the components
- Medical Treatment
- Behavioral Treatment
- Therapy candidacy
- What do we do in therapy?
- Peri-Operative Voice Therapy
- Expectations … putting knowledge into practice

Clinical Factors and Decision Making

- Patient history
  - Medical history
  - Chief of symptoms
- Laryngeal Examination
- Patient complaints
- Stimulability for behavioral change
- Readiness for change/motivation
- Patient and clinician expectations for recovery
- Candidacy for surgical intervention

‘Operational’ Factors and Decision Making

- Clinical practice model
- Comprehensive Medical and Behavioral Evaluation
- Assessing stimulability for change
  - When, how and who
  - Does it depend on the practice model?
Glottic Insufficiency - Nomenclature

- Vocal Fold Immobility/Hypomobility
  - Absent/reduced movement due to unknown cause
- Vocal Fold Paralysis/Paresis
  - Absent/reduced movement due neurogenic etiology
- Vocal fold Immobility/Hypomobility related to the mechanical impairment of the cricoarytenoid joint
  - Includes posterior glottic scarring/stenosis
- Vocal fold Immobility/Hypomobility related to laryngeal malignant disease

Rosen et al 2016

Common Causes of VF Paralysis

**Surgery**
- Carotid
- Thyroid/Parathyroid
- Spine (anterior approach)
- Mediastinal
- Esophageal
- Brain
- Skull base
- Heart - Lung

**Medical Conditions**
- Cardiac condition
- Enlarged left atrium
- Malignant disease of the left upper lung/mediastinum
- Diabetes mellitus
- Hypokalemia
- Lyme disease
- Cerebral vascular accident
  - Wallenberg stroke
- Neurotoxic chemotherapy
- Neurologic conditions

Unilateral VF Motion Impairment

Voice Evaluation Overview

- Voice
- Swallowing
- Airway
- Symptom assessment
- Impact assessment
- Medical Status

Perceptual Evaluation

- CAPE-V
  - Standard instructions
  - Standard tasks
- Common voice quality:
  - Breathiness
  - Asthenia
  - Dipsphonia
  - May be worse at lower pitches

Patient Intake/History

- Onset of Complaints – gradual, sudden
- Specific complaints
  - Voice
  - Swallowing
  - Breathing
- Vocal demand
- Medical and surgical history
- Medications
- Relevant social history

Patient reported measures:
- Voice Handicap Index (VHI)-10
- Singing VHI-10
- Dysphonia Index (DI)
- Eating Assessment Tool (EAT)-10

Lester and Ross 2005
Assessing Peri-Laryngeal Tension

Peri-laryngeal Palpation

Tension and Tenderness
- Infrahyoid
- Sternocleidomastoid
- Suprathyroid
- Submental
- Lateral motion of the Larynx

***at rest and during phonation

***Pressure equal to that it takes to blanch the thumb nail on a firm surface

Acoustic and Aerodynamic Testing

- Acoustic Measures –
  - Jitter, shimmer, noise/harmonic ratio
  - Time based acoustic measures unreliable with dysphonic voices
  - CPP reduced in those with vocal fold paralysis (Balasubramanium et al 2011)
  - CSID and CPP speech –statistically significant improvement pre- and post treatment in this population (Gillespie et al 2014)

- Aerodynamic Measures
  - Statistically significant improvement pre- and post- treatment in average airflow in syllables, average airflow in the all-voiced sentence*** (Dastalfo et al 2016)
  - Speech Aerodynamics (Gartner-Schmidt et al 2015)
    - Can be done with or without PAS
    - Duration of the first 4 sentences of the Rainbow passage and count number of breathes
    - With PAS – + average airflow

Physical Exam – Team Approach

- Endoscopy
  - Vocal fold motion
    - Position of the vocal fold
    - Vocal fold appearance
    - Contralateral side?

- Videostroboscopy
  - Vibratory parameters at various pitches
    - Phase asymmetry
    - Vocal fold closure at various pitches

Stimulability and Self-awareness

Important for the success of behavioral intervention

- Stimulability
  - Are they able to alter the sound or feel of the voice?
  - Can they follow vocal direction?

- Self-awareness
  - Is the patient aware of voice use patterns?
  - Can they identify changes in voice ease or quality?
    - With therapy and practice, can this skill develop?
Type and Location of Injury

<table>
<thead>
<tr>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iatrogenic</td>
<td>Recurrent Laryngeal Nerve (RLN)</td>
</tr>
<tr>
<td>Trauma</td>
<td>Superior Laryngeal Nerve (SLN)</td>
</tr>
<tr>
<td>Cut and reanastomosed</td>
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<tr>
<td>Sacrificed and reinnervated</td>
<td></td>
</tr>
<tr>
<td>Traumatic</td>
<td></td>
</tr>
<tr>
<td>Neoplasm and Thoracic diseases</td>
<td></td>
</tr>
<tr>
<td>Systemic (infectious, inflammatory, neurologic)</td>
<td></td>
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<tr>
<td>Ideopathic</td>
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</tbody>
</table>

Misono and Merati 2012

Nerve Recovery

- Nerve recovery ~ 9-12 months post injury (Sulica et al 2010)
- Nerve recovery may not imply meaningful vocal fold motion
- Position may change
- Vocal fold tone may improve
- Motion may return

Position & Gap

- Position of the Vocal Fold
  - Median – at midline
  - Paramedian – away from midline
  - Lateral – furthest away from midline
- Resultant Glottal Gap
  - Small, moderate, large
  - Height mismatch?

Laryngeal Examination

- Interarytenoid is bilaterally innervated (Mu et al 1994)
  - Focus on the rotation of the vocal process/arytenoid to assess meaningful motion
  - The illusion of movement may be observed with interarytenoid activation or relaxation

Considerations - Laryngeal Examination

Intact vocal fold motion
Vocal Fold Hypomobility

Vocal Fold Immobility

Mobile or Immobile? That is the question.

Laryngeal Examination – Jostle sign
- Passive movement of the arytenoid of the affected side due to contact from the other arytenoid (Sataloff 1987)
- The weak side cannot maintain resistance to pressure during adduction
- Implications – difficulty increasing intensity!

No instrumental testing??
- Various practice settings impact SLP assessment
- Key considerations –
  - Get a copy of the exam
  - Discuss needs with referring physicians
  - Measure MPT and vocal intensity
  - Know their limitations, be consistent with instructions
  - Administer patient reported measures
  - Do your best with what you have!

Medical Treatment
Medical Treatment Approaches for Unilateral Vocal Fold Paralysis

- No treatment
  - Observation
  - Surgeon’s denial
  - No access to treatment
- Static Medialization
  - Vocal fold injection
  - Laryngeal framework surgery
  - Laryngeal re-innervation

Treatment of Unilateral VF Paralysis
Decision Making

- Need for treatment
  - Observation vs. treatment
  - Dysphagia
  - Ineffective cough
  - Vocal demands
  - Life expectancy
- Timing of treatment
  - Fear of surgery
  - Return to work
  - LEMG prognosis
  - Temporary vs. permanent
- Medical conditions
  - Cardio/pulmonary status
  - Anti-coagulation status
  - Awake vs. sedated vs. asleep

Surgery for Unilateral VF Paralysis
Vocal Fold Injection

- Materials
  - “Gel” Hyaluronic Acid (Restylane™)
  - CaHA Lipoinjection
- Setting
  - Office
  - Procedure suite
  - Operating room
- Levels of Anesthesia
  - Awake
  - Sedation
  - General anesthesia

Timing of Intervention

- Is early surgical intervention better?
  - Evidence suggests that early injection medialization may be associated with a lower rate of need for permanent medialization (Yung et al 2011, Prendes et al 2012)
  - Decisions cannot be made based on glottic gap alone
- Voice outcomes for injection and permanent medialization are similar (McLaughlin et al 2018)
  - Selection bias?
  - Why??

Behavioral Intervention
Physiologic Approach informed by voice science and motor learning!

- Goals of treatment
  - Maximize voice use in the presence of the current glottic configuration
- Inform Expectations
  - Type of injury and Time from injury
  - Vocal fold position and Glottic gap
  - Voice use patterns/vocal demands
  - Stimulability for change
Behavioral Intervention
Efficacy of Voice Therapy

- Handful of studies that show improvement in various outcomes post-therapy
- Therapy techniques are inconsistently described
  - No efficacy data for specific techniques
- Single-group treatment designs
  - Nerve regeneration was not accounted for


Timing of Intervention

- Is early voice therapy better?
  - Voice therapy seems to be helpful at all stages
  - Early referral associated with greater benefit
    (Busto-Crespo et al 2016, Mattioli et al 2011)

Candidacy for Voice Therapy

- Etiology of motion impairment
- Time from onset
- Vocal demand
- Impact on voice and life
- Position of the vocal fold
- Stimulability for change!!
- Self-awareness
- Motivation

Semi-occluded Vocal Tract (SOVT)

- Create semi-occlusion in the vocal tract (generally at the lips) to increase source-filter interaction.
- The vocal folds are thought move from convergent to more squared edge that reduces phonation threshold pressure.
- The patient will sense back pressure and ‘buzz’.
- The result is an increase vocal efficiency and economy.
  (Titze 2006)
  - The role of SOVT is to:
    - Achieve balanced airflow/resonance
    - Use back pressure to reduce impact of vocal fold vibration
    - Maximize efficiency of vocal fold closure

Resonant Voice Therapy

- A voicing pattern involving oral vibratory sensations during “easy” phonation (Verdolini et al 2008)
- Vocal fold configuration is barely abducted/adducted (Verdolini et al 2008)
- The role of Resonant Voice Therapy is to:
  - Target oral/nasal resonance
  - Maximize vocal economy – maximize voice output and minimize intraglottal impact stress (Verdolini et al 2008)
  - Rebalance the 3 subsystems of voice production
- Evidence: Yui et al 2017- systematic review of RVT

Stretch and Flow Therapy

- Originally described by Stone and Casteel
- Technique to establish airflow in isolation, coordinate with phonation and focus on oral-pharyngeal resonance while maintaining minimal muscular effort (Watts et al 2015)
- The role of Stretch and Flow Voice Therapy is to:
  - Achieve improved airflow during phonation
  - Balance oral resonance
  - Reduce strain
- Evidence: Watts et al 2019 – RCT of stretch and flow vs resonant voice therapy with primary MTD
Vocal Function Exercises
- First described by Barnes in 1977, modified by Stemple in 1993
- Based on the principle of systematic exercise to increase bulk, strength, and coordination of laryngeal musculature
Goals are to:
- Sustain voiced sounds for as long as sustained /s/
- Avoid voice breaks, wavering, and breathiness
- Complete exercises as softly as possible
The role of VFE is to:
- Balance the three sub-systems of voice production
Evidence: Angadi et al 2017 – systematic review of effects of VFE

Conversational Training Therapy (CTT)
- Developed by Gillespie, Gartner-Schmidt with a Voice SLP expert consensus group
- Focuses exclusively on voice awareness and efficient voice production in patient-driven conversational narrative, without the use of a traditional therapeutic hierarchy
- 6 interchangeable tenets:
  - (1) clear speech; (2) auditory and kinesthetic awareness of voice production; (3) rapport building; (4) negative practice; (5) embedding basic training gestures into speech, and (6) varying prosody (Gartner-Schmidt et al 2016)
The role of CTT is to:
- Achieve vocal efficiency; balance 3 subsystems
- Implement in conversational speech immediately

PhoRTE
- Developed by Zeigler and Hapner, adapted from Lee Silverman Voice Treatment (LSVT)
- 4 sessions, 1 time per week
- Four exercises: 1) loud maximum sustained phonation on /a/; 2) loud ascending and descending pitch glides over the entire pitch range on /a/; 3) participant-specific functional phrases using a loud and high voice; and 4) phrases from exercise #3 in a loud and low voice.
The role of PhoRTE is to:
- High intensity exercise to possibly induce changes to muscle structure and function to reverse the degenerative sarcopenia process.
Evidence:
- Zeigler et al 2014 – RCT compared PhoRTE and VFE in patients with presbyphonia

Is there a role for Push/Pull Exercises?
- Push/Pull and Hard Glottal Attacks are described in the literature
- Not the standard
- May be a role for specific patients

Peri-Operative Voice Therapy
- Considerations:
  - Input from the surgeon
  - Healing
  - Laryngeal examination
  - Stimulability for change
  - Self-awareness
  - Motivation
- Let these factors be your guide in developing expectations for voice and developing a treatment plan

How long should voice therapy last?
- Depends on the goals of therapy...
- Pre-operative Therapy
  - 1-2 sessions
  - ‘Unload’ the patient
  - Increase awareness
  - Set expectations
- Post-operative Therapy
  - ~4 sessions
  - Rebalance subsystems of voice production to optimize post-operative voice use
- Voice Therapy
  - ~4 sessions
  - Education/Hygiene
  - Counseling/Decision making
  - Rebalance subsystems of voice production to maximize voice production in the context of the diagnosis
Putting Knowledge into Practice

Conclusions
- Comprehensive evaluation is necessary to guide therapeutic recommendations and ongoing decision making.
- While efficacy data for types of therapy is absent, there is evidence that voice therapy may be beneficial in the management of vocal fold motion impairment.
- Consider:
  - Timing and type of injury
  - Glottic gap
  - Voice use patterns and vocal demand
  - Stimulability for change, self-awareness
  - Motivation

References
References