Best practice on a tight budget:
Non-instrumental assessment and treatment of voice and resonance in adults and children

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ArkSHA State Convention, October 2014

Workshop goals
• Introduce 4 distinct categories of voice disorders;
• Identify anatomical structures responsible for the normal voice;
• Administer QOL and auditory-perceptual voice scales;
• Administer a non-instrumental assessment of voice;
• Invite audience participation in a complex case of adolescent dysphonia;

Biological role of the larynx
• Plays a sphincteral role of closing off the airway for swallow and physical exertion
• Rises for the swallow and other physical activities
• Elevates the esophagus and trachea
• Also rises in fear or panic situations

Emotional role of the larynx
• Our feelings are “heard” in the sound of the voice.
• Emotionality and vocal function are intertwined; thus effective voice therapy requires the treatment of the total person.
• The voice changes according to mood state.

Linguistic function of the larynx
• It is not always what we say that carries the message, but how we say it.
• Vocal pathologies may prevent speakers from using suprasegmentals and stress to communicate intent.

Polyvagal reflex
Phylogenetic development in response to fear. Can also manifest itself in stressful situations
Kinds of voice disorders

• Organic
• Neurogenic
• Psychogenic
• Muscle tension

Prevalence of voice disorders

• Difficult to calculate in the normal population due to:
  • Temporary conditions
  • Colds
  • Allergies
• Approximately 3%-9% of normal adults report voice disorders.

Occupational voice disorders

• Defined as a disease process caused by exposure to risks at work. Risk factors include:
  • High vocal load (term used to quantify demands placed on vocal mechanism).
  • Background noise, exceeding 40 dB.
  • Poor acoustics and increased ambient noise.

Teachers

• There are approximately 3 million elementary and secondary school teachers in the U.S.
• Greater than 70% of teachers reported experiencing voice problems over their teaching careers as compared with <10% of adults in other occupations.

Teachers

• Studies have found that children perform worse on a variety of auditory processing and memory tasks when listening to a dysphonic vs normal voice.
Vocal Amplification

- However, further studies have found that electronic vocal amplification reduces vocal load and presumably insulates the teacher from extended loud vocal use.
- Using VA, teachers reduced vocal SPL by 7 dB; and 84% of students reported that they found listening easier and 63% reported improved concentration. Jonsdottir, V. I. (2002). Cordless amplifying system in classrooms. A descriptive study of teachers' and students' opinions. Logopedics, Phoniatrics, and Vocology, 27, 29-36.

Other populations

- Elderly: 47% report voice disorders over a lifetime. Most are associated with benign lesions.
- Pre- and elementary-school children: voice disorders range from 6%–9%. It is estimated that children with voice disorders comprise approximately 5% of a school-based clinician’s caseload.

Important to attend to dysphonias

- Why is it important to refer to an otolaryngologist for a voice disorder that has persisted beyond 1-2 weeks and is clearly not associated with an URI?

Gastroesophageal Reflux Disease
Laryngopharyngeal Reflux Disease

- GERD/LPR
  - Stomach acid is refluxed upwards from the stomach into the esophagus as high as the tissue surrounding the larynx. May result in tissue irritation.
  - Long-term reflux may result in tissue damage and lesion development.

- Etiology
  - Faulty lower and upper esophageal sphincters

- Treatments
  - Referral to a Gastroenterologist and/or an ENT is indicated.
  - Management includes a change in eating and drinking habits, head of bed elevation, a trial of H2 blockers or proton pump inhibitors, Fundoplication surgery.

Silent Laryngopharyngeal Reflux

- Laryngopharyngeal reflux is often “silent,” and can contribute to tissue changes in the esophagus, hypopharynx and even nasal cavities and sinuses.

- See Dr. Jamie Koufman for educational website. Good Morning America.

Contact granulomas (ulcers)

- Contact granuloma:
  - Build-up of scar tissue posteriorly
  - Typically one-sided but may be bilateral
  - Etiology:
    - Laryngopharyngeal reflux of gastric acid
    - Vocal abuse
    - Infections; secondary to irritation of tissue and uneven tone in children and women
    - May be more prevalent in the Type A personality
    - Men are more at risk given a history of vocal abuse and irritation
    - Sometimes this pathology exists in the absence of any causal factors (idiopathic)

- Treatment
  - Proton pump inhibitors, strict vocal hygiene, behavioral voice therapy, eliminate source of irritation
Contact Ulcers: Case Study

- **Client:** 38 year old male, music salesman. Travels and speaks frequently, often without microphone. Weightlifter, but reports using the healthy strategy of exhaling while flexing. Client was overheard chastising an employee on the telephone using hard glottal attack. Recently prescribed with anti-reflux medication.

- **Complaint:** Pain in laryngeal area following bronchitis and extensive coughing and throat clearing. Occasionally expectorates small amounts of blood. Often “pushes” to get voice out.

Contact Ulcers: Case Study (continued)

- **Physiologic:** Rigid endoscopy revealed a collection of granular tissue at vocal process of the left arytenoid cartilage with slight erythema at the vocal process of the right arytenoid cartilage. Granuloma did not interfere with vibration. Thick stringy mucus noted at glottis.

Contact Ulcer Intervention and Results

- **Vocal hygiene:** Replace abusive behaviors with sniff swallow and silent cough; increase hydration to 2+ quarts per day when exercising or engaging in heavy vocal behavior.
- **Follow anti-GERD regimen; invest in personal amplification system**
- **Confidential tone, breathy voice, maintain appropriate pitch, reduce hard glottal attack by engaging in blended vowel exercises.**
- **Post therapy results:** Endoscopy reveals 80% reduction in size of ulcer.
- Recommended continue protocol.
- Surgery not recommended because many granulomas recur.

Normal Aspects of Voice

- **Normal voice can be characterized by:**
  - Loudness
  - Hygiene
  - Quality
  - Flexibility
  - Ability to represent the speaker

Normal processes of voice production

- Respiration
- Phonation
- Resonance
- Articulation
- See Iowa Phonetics Lab

Respiration

- Both speaking and singing require an outgoing air stream capable of activating vocal fold vibration.
- The conscious control of the breathing mechanism must not conflict with physiological air requirements of the individual.
- Problems usually result from a conflict between physiological needs and speaking and singing demands.
Phonation

• All ingoing and outgoing pulmonary air must pass through the glottal opening of the larynx.
• Using the larynx for phonation requires unique neural, mechanical and aerodynamic controls.
• The number of vibratory cycles per second (Fo) is in part determined by vocal fold thickness, length and elasticity.

How does it work?

• Subglottal air pressure builds up when the vocal folds are closed.
• As the subglottal pressure builds, the vocal folds separate and the pulmonary air rushes through.
• The mass of the vocal folds and the Bernoulli effect pull them back together = cycles (Hz).

Intensity

• As vocal intensity (loudness) increases, the vocal folds stay closed longer and undergo greater excursion. This may cause speakers or singers to run out of air quickly.
• Trained singers and actors increase loudness by increasing subglottal pressure and airflow rate; untrained singers tend to squeeze the little air remaining through tight vocal folds.

Resonance and articulation

• The nasal and oral cavities are critical resonators.
• Adequate VP valving is necessary for the production of intelligible speech.
• The tongue is the most mobile articulator.
• Abnormal tongue carriage may alter resonance and articulation.

Psychogenic Voice Disorders

Changes to the larynx over the lifespan

For a comprehensive account of the pediatric larynx, see LANGUAGE, SPEECH, AND HEARING SERVICES IN SCHOOLS • Vol. 35 • 297–298 • October 2004 © American Speech-Language-Hearing Association
Pediatric larynx

- Situated high in the neck, softer than an adult’s; the pediatric hyoid bone often overlaps the thyroid cartilage.
- Soft cartilages place child at risk for “malacia.”

The Pubescent Larynx

- Prior to puberty, the size of the male and female larynx are similar (265Hz.)
- In males, very rapid laryngeal growth, 1 octave pitch drop. (3-6 months)
- In females, ½ octave drop

Aged Voice

- There are numerous contributors to the aged voice.
- Mucosal secretions thicken; decreased saliva.
- Complaints of phlegm and globus.
- Ossification of cartilage.
- Acoustic and perceptual changes: breathy, soft voice is common in the aging voice.
- Pathologic changes may be secondary to a disease process.

Video of a Pediatric Larynx

Adult Larynx

- Older larynx: hardening of the cartilages, joint changes, some atrophy of muscles; degeneration of glands in the mucosa.
- Less flexibility & elasticity, loss of mass, reduced tone.

Counteracting changes in the older voice

- Increase overall physical fitness
- Increase respiratory-phonatory coordination using Linebaugh’s words-per-breath technique.
- Encourage a more rapid speaking rate.
- Employ facial focus.
Voice Assessment

• ENT physician: Laryngeal diagnosis
• Speech language pathologist: Voice function diagnosis

• These responsibilities often overlap and it is not uncommon for the trained SLP to be the first professional to clinically define a functional, organic or neurogenic disorder.

Evaluation of voice disorders

• Voice History
• Description of problem and cause
• Onset and duration
• Variability
• Description of vocal use
• Additional case history information

Quality of Life

• What percentage of experienced voice clinicians feel QOL instruments are important?
• Why?
• What is the Voice Handicap Index?
• What number of points represents a significant change in psychosocial function?

Auditory Perceptual Assessment

• GRBAS (grade, roughness, breathiness, aesthetic, strain): Developed by the Committee for Phonatory Function Tests of the Japanese Society of Logopedics and Phoniatrics.

Respiration

• Non-instrumental
• Observe mode of breathing (quiet breathing is 15-20 BPM for adults, 20-25 BPM for children).
• Observe respiratory-phonatory coordination
• Observe status of neck muscles.
• Conduct water manometer test (Hixon, Hawley and Wilson, 1982).

Phonation

• Non-instrumental:
• Keyboard: Healthy pitch is 4 notes up from basal.
• Pitch range should be about 1.5-2 octaves.
• Maximum phonation time, in seconds:
• Use tape recorder for connected speech and then play back, selecting 2-4 average notes for speaking pitch.
Maximum phonation time

Vocal agility. Typical ranges for adults are 1.5 to 2 octaves

Oral reading: Normal reading rates are 160-170 wpm.

Resonance

- Non-instrumental
- Nasal flutter on /i/ and /u/ (tests for NAE)
- Fogging mirror test
- /s/ snap release
- Nasal listening tube
- Straw from naris to ear

Articulation

- Non-instrumental
- AMRs and SMRs
- Reading rate
- See Phoneme Identification
- Task and Mayo Clinic handout

Inspect oral cavity
Instrumental Assessment

- Videoendoscopy/stroboscopy (LVES)
- Is not the sole province of the physician
- Endoscopists should be appropriately trained in the areas of A&P and must be able to operate and maintain the equipment necessary to perform LVES.

Acoustic Assessment

- Visi-Pitch
- Computerized Speech Lab
- Pitch range (1.5 to 2 octaves)
- Relative Average Perturbation (jitter)
- Shimmer
- Normative measures: Male, 125 Hz; female, 225 Hz; child 275 Hz, RAP .80% or lower; shimmer 3.89% or lower

Airflow

- Is typically measured in ccs or mL
- Average transglottal airflow for an /a/ is . .
- Which populations tend to show higher transglottal airflows than adults?
- The Phonatory Aerodynamic system analyzes flow rate, sound pressure level, Fo, and vital capacity, among others.

Differential diagnosis of a complex voice disorder

- 60-year old male teacher
- 14 month hx of voice disorder.
- Status post removal of thyroid, followed by improved vocal quality, but quality subsequently deteriorated.
- Suspected vocal fold paralysis secondary to RLN paralysis.
**Voice Handicap Index (VHI)**  
(Jacobson, Johnson, Grywalski, et al.)  
Henry Ford Hospital

**Instructions:** These are statements that many people have used to describe their voices and the effects of their voices on their lives. Check the response that indicates how frequently you have the same experience.  
(Never = 0 points; Almost Never = 1 point; Sometimes = 2 points; Almost Always = 3 points; Always = 4 points)

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Almost Always</th>
<th>Always</th>
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<tbody>
<tr>
<td>F1. My voice makes it difficult for people to hear me.</td>
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<td>P2. I run out of air when I talk.</td>
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<td>F3. People have difficulty understanding me in a noisy room.</td>
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<td>P4. The sound of my voice varies throughout the day.</td>
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<td>F5. My family has difficulty hearing me when I call them throughout the house.</td>
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<td>F6. I use the phone less often than I would like.</td>
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<td>E7. I’m tense when talking with others because of my voice.</td>
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<td>F8. I tend to avoid groups of people because of my voice.</td>
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<td>E9. People seem irritated with my voice.</td>
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<td>P10. People ask, “What’s wrong with your voice?”</td>
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<td>F11. I speak with friends, neighbors, or relatives less often because of my voice.</td>
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<td>F12. People ask me to repeat myself when speaking fact-to-face.</td>
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<td>P14. I feel as though I have to strain to produce voice.</td>
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<td>E15. I find other people don’t understand my voice problem.</td>
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<td>F16. My voice difficulties restrict my personal and social life.</td>
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<td>P17. The clarity of my voice is unpredictable.</td>
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<td>P18. I try to change my voice to sound different.</td>
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<td>F19. I feel left out of conversations because of my voice.</td>
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<td>Item</td>
<td>Scale</td>
<td>Group</td>
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<td>Mild</td>
<td>Moderate</td>
<td>Severe</td>
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<tr>
<td>Physical</td>
<td>10.07 (1.99)</td>
<td>12.41 (1.38)</td>
<td>18.30 (1.50)</td>
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<tr>
<td>Emotional</td>
<td>15.54 (1.97)</td>
<td>18.63 (1.37)</td>
<td>22.78 (1.48)</td>
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<tr>
<td>Total</td>
<td>33.69 (5.60)</td>
<td>44.37 (3.88)</td>
<td>61.39 (4.21)</td>
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Note: The letter preceding each item number corresponds to the subscale (E = emotional subscale, F = functional subscale, P = physical subscale).

VOICE HANDICAP INDEX (VHI) Scoring (Henry Ford Hospital, 1997)

The VHI is comprised of a series of questions targeting the patient's perception of her/his own voice. It is a useful tool to help gain insight into the emotional, physical, and functional components of the voice problem as well as measure therapeutic outcomes.

Scoring Guidelines: Mean values (SD) for VHI subscale and total scale scores as a function of self-perceived severity.

A change of 18 points in a total score or 8 points on any subscale (emotional, functional, or physical) is considered statistically significant. (Jacobson, B.H., Johnson, A.I., Grywalski, C., Silberglied, A., Jacobson, G., Benninger, M.S., et al. (1997), The Voice Handicap Index (VHI): Development and validation. American Journal of Speech-Language Pathology, 6, 66-70.)
Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)

Voice Sample #:____________________________

Date:__________

The following parameters of voice quality will be rated upon completion of the following tasks:

1. Sustained vowels, /a/ and /i/ for 3-5 seconds duration each.

2. Sentence production:
   a. The blue spot is on the key again.
   b. How hard did he hit him?
   c. We were away a year ago.
   d. We eat eggs every Easter.
   e. My mama makes lemon muffins.
   f. Peter will keep at the peak.

3. Spontaneous speech in response to: "Tell me about your voice problem." or "Tell me how your voice is functioning."

### Legend:
- C = Consistent
- I = Intermittent
- MI = Mildly Deviant
- MO = Moderately Deviant
- SE = Severely Deviant

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<tr>
<th>Parameter</th>
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<td>Overall Severity</td>
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<td></td>
<td>MI</td>
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<td>SE</td>
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<td>Roughness</td>
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<td>MI</td>
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<td>Breathiness</td>
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<td>SE</td>
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<td>Strain</td>
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<td>Pitch</td>
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<td>Loudness</td>
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<td>(Indicate nature)</td>
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</table>

Score: __________________________

Comments about Resonance: Normal

Other (Provide description): __________________________

Additional Features: (for example, diplophonia, fry, falsetto, asthenia, aphonia, pitch instability, tremor, wet/gurgly, or other relevant terms):

Clinician: __________________________