Duke Voice Care Center offers three exciting events celebrating World Voice Day 2012

**Thursday, April 5**
Tips for Overcoming Hoarseness and Maximizing Your Voice  
6:30-8:00 p.m.  
Teer House, 4019 N. Roxboro Road, Durham

**Saturday, April 14**
Care of the Singing Voice  
9:00-noon  
Unitarian Universalist Fellowship of Raleigh  
3313 Wade Avenue, Raleigh

**Tuesday, April 24**
The Voice of Experience: Vocal Health for Broadcasters and Occupational Voice  
Broadcasters, teachers, clergy, call center operators — anyone with a vocally demanding job will benefit from learning how to keep the voice healthy.  
6:00-9:00 p.m.  
North Carolina Museum of Natural Sciences  
11 West Jones Street, Raleigh

**With special guest Carl Kasell of NPR**

Free admission  
Registration required  
888-ASK-DUKE  
Dukehealth.org/events
Care of the Singing Voice: How to Make Your Voice Last a Lifetime

David Witsell, MD, MHS
Leda Scearce, MM, MS, CCC-SLP
Emily Wolber, MEd, CCC-SLP
Duke Voice Care Center

Raleigh, North Carolina

Durham, North Carolina
Duke Voice Care Center Team

David L. Witsell, MD, MHS: DVCC Director
Seth M. Cohen, MD, MPH; Richard Scher, MD; Eileen Raynor, MD

Caroline Banka, MS, CCC-SLP: Speech Pathologist
Hilary Bartholomew, MS, CCC-SLP: Speech Pathologist
Leda Scearce, MM, MS, CCC-SLP: Speech pathologist and Singing Voice Specialist
Gina Vess, MA, CCC-SLP: Speech pathologist
Emily Wolber, MEd, CCC-SLP: Speech Pathologist
Outline

• Voice Production
• Anatomy
• Evaluation
• Common Vocal Fold Lesions
• Management and Prevention
• Physiology and Acoustics of Singing
• Vocal Fitness for Singers
What our voices mean to us

- Personal identity, self-esteem and self-image
- The voice is our instrument
- Livelihood and income
- Quality of life:
  - Source of artistic and creative expression
  - Source of relaxation and fun
  - Source of worship and spiritual activity
- All of which is jeopardized by a voice injury!
Vocal Performers: High risk for voice injury

- Need to perform at extremes of pitch and loudness levels
- Often use their voices more than non-performers
- Usually gregarious, talkative people

- Occupational problems
  Travel, changing environments, lifestyle, medical conditions

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The Vocal Health Quadrangle

<table>
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<tr>
<th>Medical factors</th>
<th>Vocal Pacing</th>
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</thead>
<tbody>
<tr>
<td>Vocal Hygiene</td>
<td>Vocal Efficiency</td>
</tr>
</tbody>
</table>

A problem in any or all quadrants → voice problem and/or voice injury
Normal Voice Production

- **Power Supply** – Gives airflow
- **Vibrator** – Converts air into sound
- **Resonator** – Shapes the sound into human voice
Laryngeal Anatomy
Voluntary Control of Vocal Fold Closure
Build up Pressure at Level of Vocal Folds

- Determined by
  - Force of expelled air
    - Vocal fold closure
    - Force of expelled air
- Amount of pressure
  - Loudness
Pitch Changing

- Higher pitch depends on stiffening the vocal folds
- Transition from chest voice to head voice
Stiffening of the Vocal Folds
Vibrating Layer of the Vocal Folds
Vocal Tract

- Creates human voice
- Articulation
Can we see the vibration of the vocal cords? ....... Stroboscopy

- Allows examination of the vibratory patterns at various pitch/loudness levels
- Provides information
  - Flexibility
  - Vocal fold closure
What Happens When Things Go Wrong
Chief Complaints

• I get tired when I sing
• I have lost my upper range
• I get hoarse when I sing
• My voice has not improved since my illness
• I went for a note and something happened
• My voice breaks when I sing
Vocal Fold Lesions

- Response to injury – result from trauma
- Arise in the outer layers
- Inefficient breath coordination
- Overuse
- Interfere with vocal cord vibration
  - Stiffen cover
  - Impair how well the vocal folds close
Factors Contributing to Traumatic Vocal Fold Injury

- Inefficient voice use, overuse
- Infection
- Chronic irritation
  - Allergy
  - Reflux
  - Asthma
  - Sinusitis
  - Tobacco
  - Alcohol
  - Altered mucous
    - Water
    - Caffeine
Vocal Fold Nodule
Vocal Fold Polyp
Vocal Fold Fibrous Mass
Vocal Fold Varix
Vocal Fold Bleed
Thick Mucous
Muscle Tension Dysphonia
Laryngeal Cancer

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Management

• Behavioral
• Medical
• Surgical management
  – Post-operative speaking and singing voice therapy
Behavioral Management: Taking Care of Your Voice
Vocal Hygiene

The things we do to keep the voice healthy

- Taking care of the body
- Using the voice well
Vocal Hygiene: Hydration

Drink plenty of water

• The better hydrated you are, the more efficiently the vocal folds vibrate

• Well-hydrated vocal folds may be less likely to get hurt from voice use

• How much? At least 64 ounces per day
Other things that can affect hydration

- Caffeinated beverages
- Alcohol
- Dry environments
- Medications
Vocal Hygiene: Smoking

Smoking and singing don’t mix!

- Vocal cord irritation
- Smoking causes coughing, which can cause vocal fold injury
- Long-term exposure to tobacco smoke actually changes the tissue in the vocal folds
- Causes laryngeal cancer
- Second-hand smoke counts too!
Vocal Hygiene: Taking Care of Your Body

Maximize your resistance to illness
• Exercise regularly
• Eat well
• Sleep well

Minimize your risk of infection
• Wash hands often and well
• Keep hands away from mouth and eyes
• Avoid contagion whenever possible
Lozenges

- Avoid Menthol and eucalyptus
- Suggestions:
  - Halls Breezers, Luden’s berry flavors, Grether’s Pastilles, Thayer’s Slippery Elm
- Look for glycerin or pectin as active ingredient
Vocal fold edges come into contact with every cycle of vibration

- Easy, gentle contact $\rightarrow$ vocal resilience
- Hard, forceful contact $\rightarrow$ vocal fold injury
Vocal behaviors that can be harmful to your voice

- Yelling, screaming and hollering (including cheerleading)
- Throat clearing and coughing
- Loud talking
- Talking in noisy situations (sporting events, restaurants, bars, parties social gatherings, industrial settings)
- Singing
Avoiding a Vocal Fold Injury

- Avoid coughing or hard throat-clearing
- Avoid talking or singing if you have a cold or laryngitis
Avoiding a Vocal Fold Injury

• Use non-vocal alternatives for spirit activities or to get someone’s attention
  – Bell, whistle, hand gesture, etc.

• Minimize raising your voice in noisy environments
  – Get close to the person you want to speak to
  – Move to a quieter area
Avoiding a Vocal Fold Injury

• Avoid whispering
• Avoid grunting with heavy exercises
• Use a hands-free device or hold the receiver in your hand when you speak on the telephone
• Always use a microphone when indicated
Avoiding a Vocal Fold Injury

• Avoid speaking in stressful situations or when you are overly tense
• Women should be especially careful to limit vocal demands just prior to and during the menstrual cycle
Learn to use your speaking voice well

• Posture
• Good breath support
• Frontal placement of the tone
• Minimizing muscle tension and straining
Medical and Surgical Management of Voice Problems
Medical and Surgical Management

- Many medical problems can affect the voice
- Medications used to treat medical problems can affect the voice
Rhinitis Management

- Can be allergic or non-allergic
- Oral antihistamines and decongestants are very drying to vocal folds
- Nasal treatments are better choice for singers
  - Nasal steroid spray
  - Nasal antihistamine
  - The way you apply it makes a difference in how effective the medicine will be!
Sinus Irrigation

NeilMed Products, Inc.

Sinus Rinse™
A Complete Saline Nasal Rinse Kit™

Preservative Free

Sinus Rinse™ helps alleviate:
- Nasal allergies
- Chronic sinus disease
- Nasal irritation from occupational dust, fumes, animal dander, grass, pollen, smoke, smog & house dust
- Post nasal drip, congestion and nasal dryness

Advantages:
- Preservative, Iodine & Latex Free
- Custom designed cap to fit any nasal opening and also adaptable to powered oral irrigation system
- Smooth flow with easy-squeeze bottle
- Employs 100% in upright position
- Premixed packets of Sodium Chloride & Sodium Bicarbonate (natural ingredients)
- pH balanced & isotonic solution
- No burning or stinging
- Great to use after sinus surgery
- Safe during pregnancy
- Travel-size kit
- Money back guarantee*

*If returned within 30 days from the date of purchase

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Vocal Hygiene: Reflux

Stomach acid is very corrosive

- If it comes into contact with the voice box, it can cause irritation, burning or swelling
- It can also make vocal fold injuries worse and slow down the healing process for these injuries
Reflux and Diet

• Avoid foods and drinks including:
  - Spicy foods
  - Food and drinks that are high in acid (citrus fruits and drinks, tomatoes)
  - Alcohol
  - Fried and fatty foods
  - Caffeine
  - Carbonated drinks
  - Mint
  - Chocolate
Reflux Management

• Medication
• Avoid exercise or singing after a meal
• Wait for 3-4 hours before lying down after eating or drinking
• Raise the head of your bed by six inches
• Begin a weight-loss program if you are overweight
• Drink at least eight eight-ounce glasses of water per day
Surgical Management

• Operative Indications
  – Lesion is enlarging
  – Medical and behavioral modifications have failed despite patient compliance
  – Patient cannot perform to desired level
  – Performance schedule cannot be maintained
Principles of Advanced Surgical Management

• Goals of Surgical Treatment
  – Minimize or avoid injury to normal tissue
  – Restoration of normal vocal fold vibratory pattern
  – Optimize voice result
Vocal Pacing
Vocal Pacing Golden Rule

- Warm up your voice before singing, cool down your voice after singing
The Vocal Clock

- Quantity of voice use may contribute to a voice problem
- Give yourself “voice breaks”
- Look for opportunities to rest your voice
- Plan your voice use
Vocal Pacing

Plan your voice use

- Write down voice use and voice rest in your schedule/planner for several weeks or even months in advance
- Color code different types of voice use to help in planning
- Keep a voice journal to track and evaluate voice use
- Adjust voice use accordingly

Duke Voice Care Center
<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
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<tbody>
<tr>
<td><strong>AM VOICE</strong></td>
<td><strong>10-12 Blocking L’Etoile</strong></td>
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<td><strong>10-12 Run Act 1 L’Etoile</strong></td>
<td><strong>10-12 Blocking L’Etoile</strong></td>
<td><strong>10-12 Run Act II L’Etoile</strong></td>
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<tr>
<td><strong>REST</strong></td>
<td><strong>Matinee The New Moon</strong></td>
<td><strong>1-4 Sitzprobe Waltz Dream</strong></td>
<td><strong>Matinee Orpheus in the Underworld</strong></td>
<td><strong>1-4 Dress Reh. Waltz Dream</strong></td>
<td><strong>1-4 Blocking L’Etoile</strong></td>
<td><strong>1-4 Dress Reh. Waltz Dream</strong></td>
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<td><strong>7-10 Run-thru</strong></td>
<td><strong>Orpheus in the Underworld</strong></td>
<td><strong>Performance Waltz Dream</strong></td>
<td><strong>Performance Patience</strong></td>
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Vocal Pacing

Plan your voice use

– Rest your voice before and after a big singing day
– Monitor voice use during rehearsals
Vocal Pacing

Monitor speaking voice use

• Look for opportunities to off-load voice use

• Be mindful of social voice use
  – “the art of the brief appearance”
  – avoid socializing in noisy places
Vocal Pacing

Monitor voice use in rehearsals

- “Mark” when possible
- Don’t sing full voice in staging/choreography rehearsals, etc.
Special Considerations for Singers

Know your limits
- Range
- Loudness
- Stamina

Try not to “spend” your voice on learning the music
“Mental practice”

- Think through the song while listening to a recording
  - Listen 3 times/sing one time, etc.

- Use unvoiced lip trill or raspberry to practice breath flow without voice use
Vocal Pacing

Mental practice

• Do your memorization and interpretive planning mentally before singing through the piece
• Plan which piece and which parts of pieces need the work
Special Considerations for Music Directors/Choral Conductors

• Warm up your voice before rehearsal
• Use amplification for your voice during rehearsal
• Use printed signs or hand signals to communicate messages that you say over and over
• Minimize using your voice to teach the music
Special Considerations for all Voice Professionals

You are your instrument!
You have greater voice demands than people who don’t use their voices for singing
How Will I Know if I Have a Voice Injury?

• Change in voice quality that lasts for more than 2 weeks
  – Hoarse, raspy, breathy, gravelly
• Loss of voice loudness
• Loss of voice range
• Voice breaks
• Change in the amount of effort it takes to speak or sing
• Decrease in vocal stamina

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What Should I Do if I Think I Have a Voice Injury?

The voice care team:

- Laryngologist
- Speech-pathologist
- Singing voice specialist

**As a singer, you deserve and owe it to your voice to get the care these specialists can provide**
Duke Voice Care Center: The Team Approach

- Comprehensive voice evaluation
- Personalized treatment plan to maximize your healing and to prevent future injuries
- Speaking and singing voice therapy
  - In-depth work on vocal hygiene
  - Strategies to idealize your environment for your best vocal health
  - Training in how to use your speaking and singing voice in the most efficient way
Classical and Belt Technique

Both:
Evolved over time
Developed from need to project voice over large instrumental ensemble in a large auditorium.
Mechanics of Singing

- Larynx position
- Resonator shape/length
- Vocal fold stiffness
- Phase closure
- Subglottic pressure
  - Air flow + vocal fold closure
- Degree and location of compression
- Thickness of vocal fold edges
- Primary muscle activation
- Vocal fold/vocal tract interaction
Mechanics of Singing

- Larynx position
- Resonator shape/length
- Vocal fold stiffness
- Phase closure
- Subglottic pressure
  - Air flow + vocal fold closure
- Degree and location of compression
- Thickness of vocal fold edges
- Primary muscle activation
- Vocal fold/vocal tract interaction
Mechanics of Singing: Classical

Classical
• Elongated resonator
• Moderate subglottic pressure
• Elevated soft-palate/pharyngeal throat widening
Mechanics of Singing: Classical

Classical
- Low larynx position
- Pharyngeal widening
- Smaller mouth opening/rounded lips
- “inverted megaphone mouth”

Titze and Worley, 2009; Titze et al 2011
Classical:
Joseph Callejo: *Nessun Dorma*

http://www.youtube.com/watch?v=Nn16xQxo0vc&feature=player_detailpage#t=116s
Mechanics of Singing Belt

- Short resonator
  - High laryngeal position
  - Wide mouth/lip retraction:
- High subglottic pressure
- Narrowing of pharynx

Titze et al 2011; Titze et al 2009; Sundberg et al 1993; Bestebrustje et al 2000; Stone et al 2003
Mechanics of Singing Belt

Short resonator
- High laryngeal position
- Wide mouth/lip retraction:
  - “megaphone mouth”

Titze and Worley, 2009; Titze et al 2011
Belt:

Adele: *Rolling in the Deep*

[video]

http://www.youtube.com/watch?v=0ckIulg1DfQ
Acoustics of Singing/
Physics of Sound

Frequency = Number of vocal fold vibrations per second
- "A 440" = 440 Hertz = 440 vibrations per second
- Perceived as pitch
- Fundamental Frequency = The note that is played/sung

Harmonics:
- Other frequencies that occur in any periodic tone
- Occur in specific mathematical proportion

Timbre/tone color:
- Determined by which harmonics get emphasized by the instrument
Harmonics
Visual Representations of Sound

Waveform Envelope (A)

Spectrogram (A) 5 kHz
cursor 4010 ms 211 Hz

Power Spectrum

Waveform Envelope (B)

Spectrogram (B) 5 kHz
cursor 4197 ms 211 Hz

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Acoustics of Singing

Classical vs Belt
• Different harmonics get emphasized
• This is why they sound different to our ear
Classical:

Joseph Callejo: *Nessun Dorma*

http://www.youtube.com/watch?v=Nn16xQxo0vc&feature=player_detailpage#t=116s
Belt:

Adele: *Rolling in the Deep*

http://www.youtube.com/watch?v=0ck1ulg1DfQ
Acoustics of Singing: Classical vs. Belt

Joseph Callejo: B4

Adele: B4
## Classical vs. Belt

<table>
<thead>
<tr>
<th></th>
<th>Classical</th>
<th>Belt</th>
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</thead>
<tbody>
<tr>
<td>Long resonator</td>
<td>Short resonator</td>
<td></td>
</tr>
<tr>
<td>• Rounded lips</td>
<td>• Retracted lips</td>
<td></td>
</tr>
<tr>
<td>• Low larynx</td>
<td>• High larynx</td>
<td></td>
</tr>
<tr>
<td>Inverted megaphone mouth</td>
<td>Megaphone mouth</td>
<td></td>
</tr>
<tr>
<td>Wide pharynx</td>
<td>Narrow pharynx</td>
<td></td>
</tr>
<tr>
<td>Moderate subglottic pressure</td>
<td>High subglottic pressure</td>
<td></td>
</tr>
<tr>
<td>F0 carries energy</td>
<td>Second harmonic carries energy</td>
<td></td>
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</tbody>
</table>
Vocal Exercise for Singing: An Overview
Speaking and Singing Voice Exercise

- Postural adjustments
- Relaxation and stretching exercises
- Abdominal breathing exercises
- Resonant voice exercises
- Speaking voice exercises
- Singing voice exercises
Postural adjustments for voice use

- Feet hip distance apart
- Knees soft and slightly flexed (not locked)
- Abdomen soft
- “Meathook” under the lower end of the sternum
- Shoulders relaxed, down and very slightly forward
- Neck long
- Feel like you are suspended from the ceiling by a thread attached to the crown of your head
Relaxation and Stretching Exercises

• Let your hands and arms do the reaching, keeping your head and neck upright.
• Remember not to hold your breath—breathe through the movement!
• In general, slower is better.
Relaxation and Stretching Exercises

• Massage: face, neck, shoulders
Relaxation and Stretching Exercises

• Base of tongue/floor of mouth
• Laryngeal massage
Relaxation and Stretching Exercises

- Face stretches
- Jaw and tongue stretches
- Neck stretches
- Shoulder rolls
Breathing Exercises

Abdominal/diaphragmatic breathing

The diaphragm is shaped like a parachute
Breathing Exercises

Abdominal/diaphragmatic breathing
Breath/Breath Support Exercises

Abdominal/diaphragmatic breathing

- Breathe in, blow out
- Breathe in, exhale on unvoiced sounds: /s/, lip trill, tongue trill, etc.
- Breathe in, exhale on voiced sounds: /z/, lip trill, tongue trill, etc.
Vocal Exercise for Singing

What sounds?
What syllables?
What pitch patterns?
What articulation type?
Vocal Exercise for Singing: Sounds

Choose sounds/phonemes based on the following guidelines:

• “Semi-occluded vocal tract sounds”
  – Lip trills
  – Tongue trills
  – Raspberries
  – Kazoo buzz
  – Fricatives (/v/, /z/, etc.)
  – Straw phonation
Vocal Exercise for Singing: Sounds

“Semi-occluded vocal tract sounds”

• Promote
  - steady breath flow
  - breath connection
  - laryngeal relaxation
  - dynamic control

AND

• Allow for self-monitoring of breath flow — i.e., if breath is not flowing steadily, the sound will stop.
Vocal Exercise for Singing: Sounds

Nasal consonants (/m/, /n/, “ng”)

- Promote frontal placement
- Reduce pharyngeal muscle tension and “woofy” tone quality
- Can facilitate reduction of laryngeal muscle tension
Vocal Exercise for Singing: Syllables

Facilitating consonants can be a helpful “step” in transitioning skills to improve vowel production.
Vocal Exercise for Singing: Syllables

Nasal consonant → vowel
improves resonance in vowels

“y” → vowel
reduces jaw/tongue tension

lip trill → vowel
promotes initiation of breath flow
Vocal Exercise for Singing

Vowels:

• Promote pharyngeal control, purity of tone quality, diction, vocal flexibility and precision.
Vocal Exercise for Singing: Pitch Patterns

Choose pitch patterns based on the following guidelines:

• Glides promote
  – smooth breath connection and breath control
  – vocal flexibility and strengthening
  – self-monitoring of breath flow

Start with short intervals and gradually increase as skills increase

(1–3–1; 1–5–1; 1–8–1)
Vocal Exercise for Singing: Pitch Patterns

Scales promote
• Vocal flexibility
• Agility
• Precision
• Pitch accuracy

Alternating glides/scales can help promote breath control.
Vocal Exercise for Singing: Pitch Patterns

Arpeggios promote

• smooth, connected breath support
• vocal flexibility and agility
• improve vocal range
Vocal Exercise for Singing: Articulation

Choose articulation based on the following guidelines:

• **Staccato exercises:** Promote pitch accuracy, vocal precision.

• **Legato exercises:** Promote vocal flexibility and agility.
Vocal Exercise for Singing: Cool-down

• Laryngeal massage
• Glides from high to low, gradually decreasing range of glide
• Speaking voice exercises (syllable, word, phrase)
Duke Voice Care Center Team

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