# Functional and Prophylactic Breathing Exercises for Patients with Inducible Laryngeal Obstruction

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**GLATA**
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# Thank you


# Presenter Conflict

- Salary:  Purdue University
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# Acknowledgement


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# Learning Objectives

- **Participants will be able to:**
  - **1. Recognize the influence of respiratory muscle fatigue on performance.**
  - **2. Provide examples of functional rehabilitation programs for athletes with ILO.**
  - **3. Distinguish between prophylactic and treatment utilization of breathing exercises.**
  - **4. Develop a collaborative plan with athletes with ILO to utilize exercises prophylactically.**

# Influence of Respiratory Muscle Fatigue on Performance

- Athletes train specific muscles for specific sports.
- Respiratory muscles are utilized in ALL sports
- When respiratory muscles become fatigued, peripheral muscles get less oxygen and performance decreases
- To improve overall muscular output and performance, respiratory muscles should also be trained[1,2]

# Effects of Inspiratory Muscle Training in Adolescent Athletes with EILO[3]

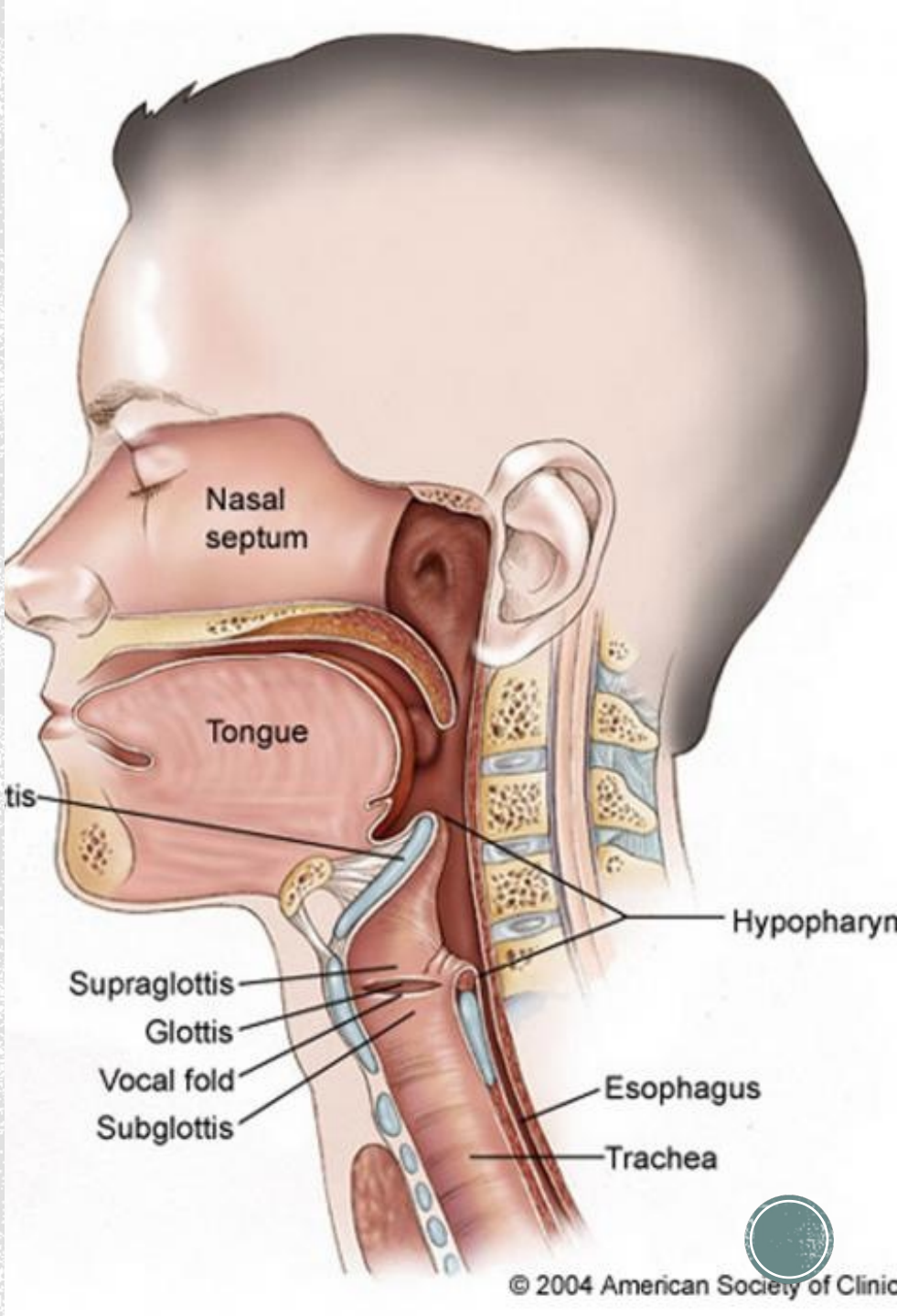
- Following 5 weeks of IMT
  - Reduction of perceived breathlessness
  - Improved respiratory endurance
  - Improved quality of life

# Terminology

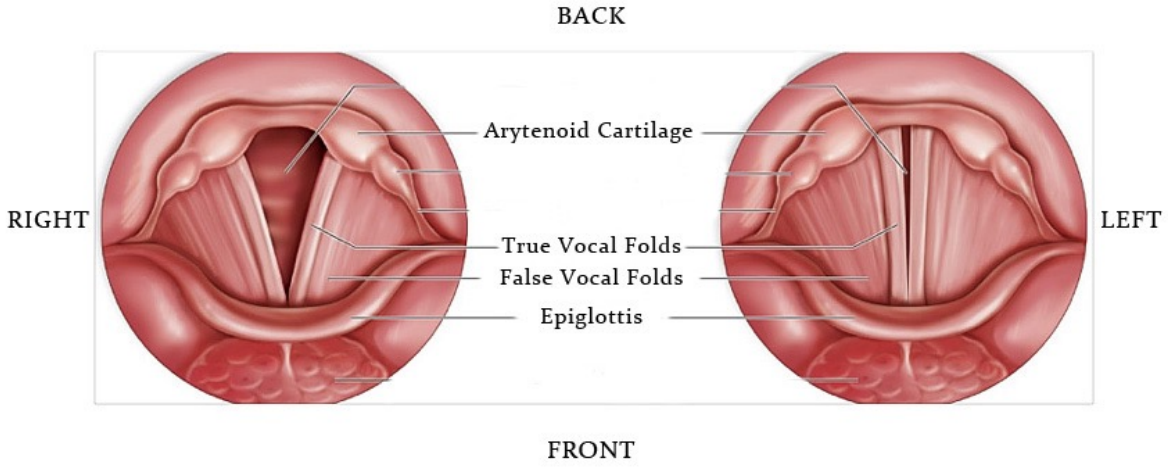
- VCD – VOCAL CORD DYSFUNCTION
- PVFD – PARADOXICAL VOCAL FOLD DISORDER
- PVFM - PARADOXICAL VOCAL FOLD MOVEMENT DISORDER
- INSPIRATORY BREATHING PROBLEMS
- **EILO – EXERCISE INDUCED LARYNGEAL OBSTRUCTION**
- **ILO – INDUCIBLE LARYNGEAL OBSTRUCTION**

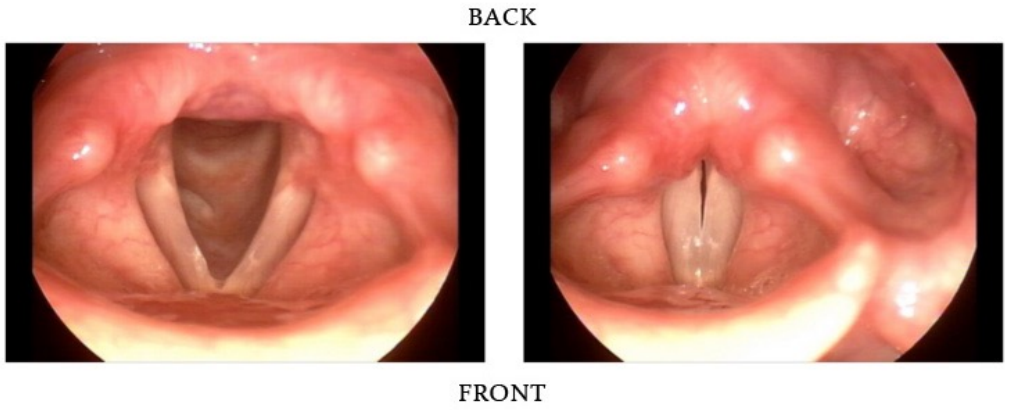
# Laryngeal Basics

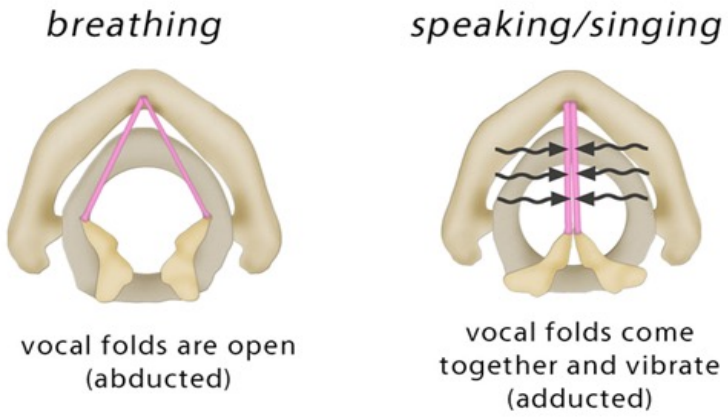
- Vocal cords sit atop the trachea
- Act as a valve
- Valve open – breathing
- Valve closed – airway protection (i.e., swallowing, holding breath)
- Valve closed with intentional airflow passed through – speaking, singing, coughing



# The True Vocal Folds (TVF)

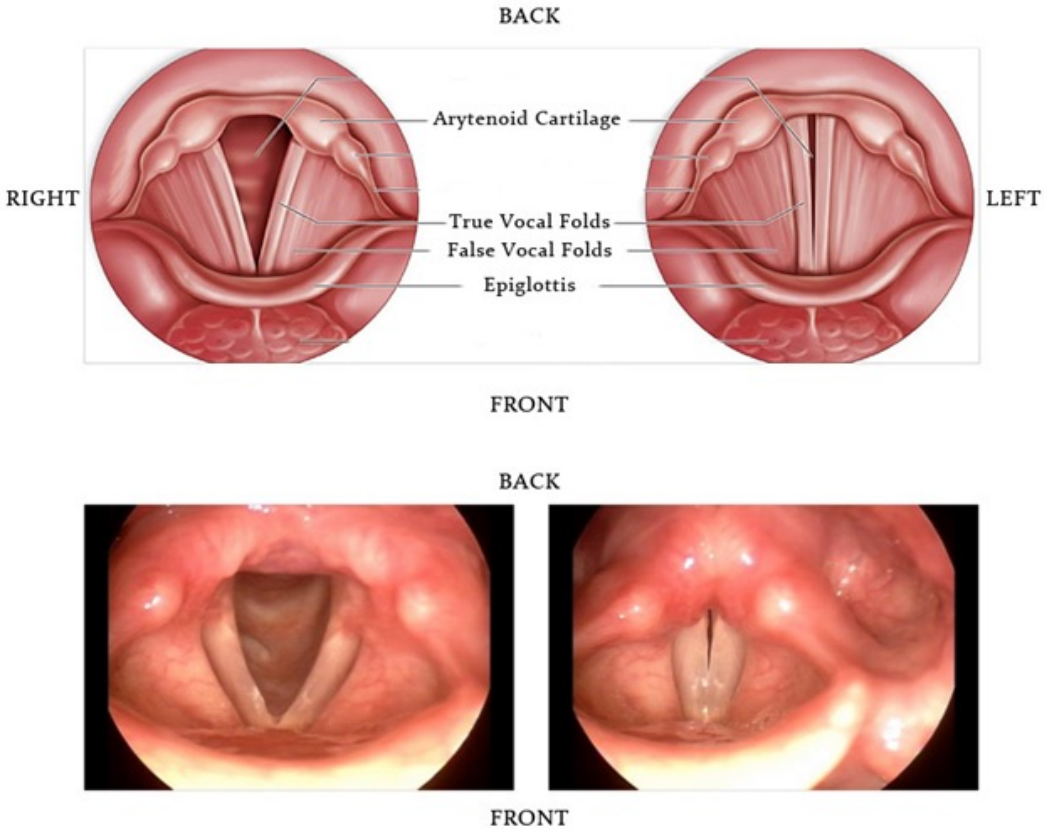



*view: lookng down the throat, onto the larynx*

www.voicescienceworks.org




# What happens during an episode of ILO?

- A trigger is present
  - Internal: emotional stress
  - External: exercise (has its own category: EILO), airborne irritant, GER/LPR, laughter, talking
- Obstruction occurs at the level of the larynx
  - Supraglottic location: arytenoid region, epiglottis, ventricular folds
  - Glottic location: true vocal folds
- Breathing difficulty is experienced
  - Inspiratory cycle
  - Expiratory cycle
  - Both

# Get to know the vocal cords

- https://www.youtube.com/watch?app=desktop&v=kfkFTw3sBXQ
- https://www.youtube.com/watch?v=9Tlpkdq8a8c
- https://www.youtube.com/watch?v=gmNwpJf1zUQ

# Signs / symptoms

- Dyspnea
- Stridor on inhalation
- Tightening in the throat or chest
- Feeling of suffocation
- Choking feeling
- Dizziness
- Tachycardia
- Tachypnea

Panic / Anxiety?

## Separating the Symptoms

**http://www.allergyasthmanetwork.org/education/related-conditions/common-related-conditions/vocal-cord-dysfunction/**

**EILO/VCD is often mistaken for asthma, especially exercise-induced asthma (EIA).**

| | EILO/VCD | EIA |
|---|---|---|
| Tightness | in throat | middle or lower chest |
| Wheezing or high-pitched sound | when breathing in; hoarse voice | when breathing out |
| Recurrence | symptoms can recur immediately and more severely when exercise resumes | symptoms tend to be less severe when exercise resumes (after bronchodilator use) |
| Recovery time | may take less than 10 minutes | usually takes up to an hour without medication |
| Medications | bronchodilator won't help | bronchodilator will help |

# Assessment

- **Figure out what it IS NOT.**
  1. Asthma (although can co-occur)
     - Pulmonary function tests (spirometry)
  2. Cardiac problems
     - Exercise stress test
     - Echocardiogram
  3. Lower airway disease
     - COPD or infectious disease processes diagnosed by MD
  4. Pulmonary obstruction or lesion
     - chest CT
  5. Structural abnormality of the upper airway
     - Laryngoscopy

# Assessment

- Assessment components
  - Clinical history
  - Laryngoscopic observations
  - Continuous laryngoscopy (in the case of EILO)
  - Symptom indices
    - Dyspnea and related symptoms
    - Reflux
    - Stress

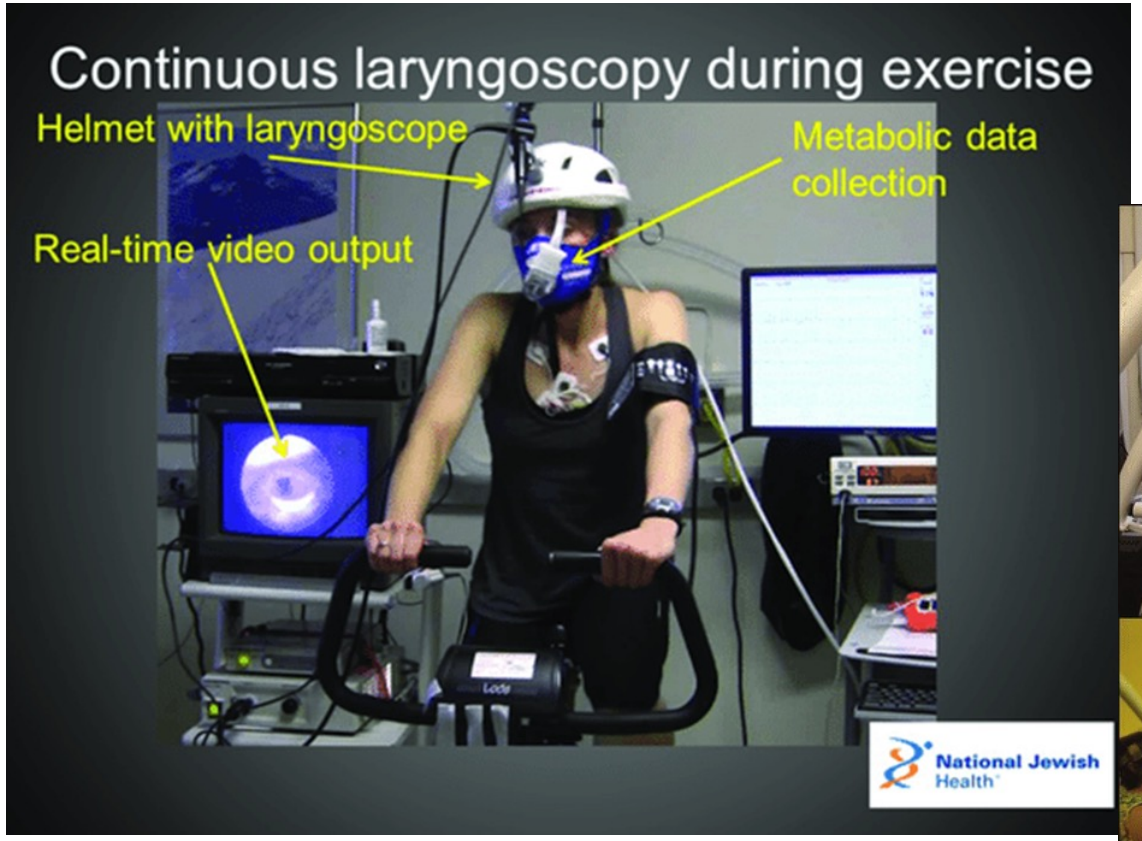
# Clinical History

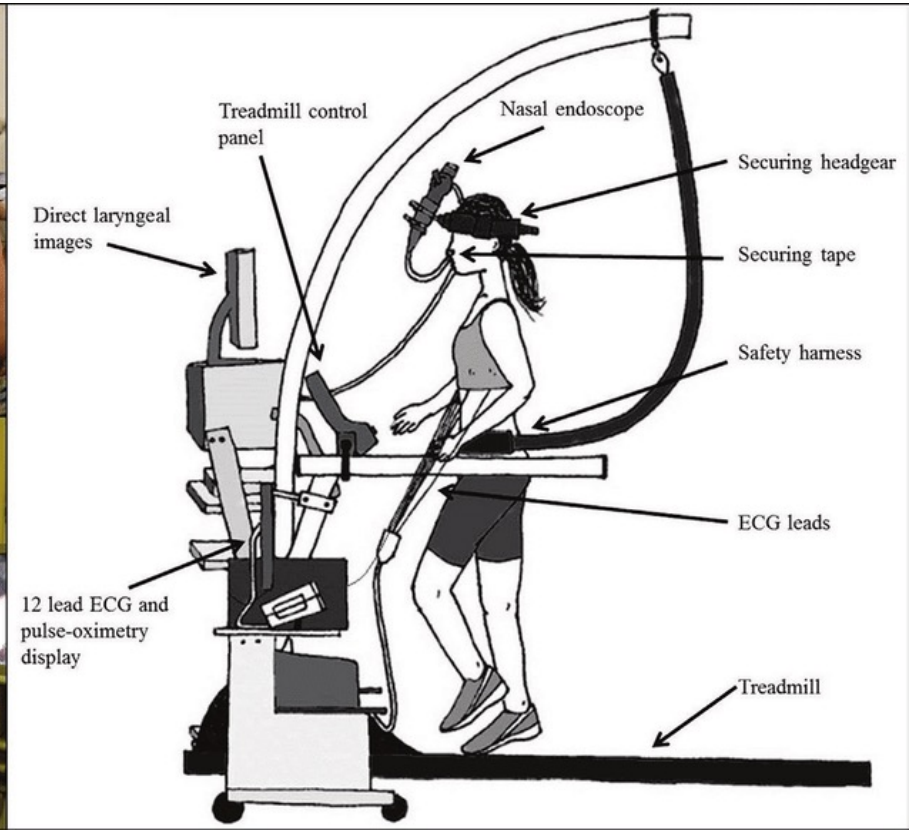
- Review of symptoms
- Review of prior testing
- Thorough understanding of the problem as explained by the patient
- Salient characteristics:
  - Sudden onset and rapid recovery
  - Inspiratory difficulty > expiratory difficulty
  - Stridor > wheezing
  - Often associated dysphagia and dysphonia
  - Minimal (if any) response to bronchodilators

# Laryngoscopic Observations

- Most likely will be normal when patient is asymptomatic
  - Unless there is a laryngeal dystonia; may see tremor, twitching
- May see evidence of chronic irritation
- When trigger is presented, should see spontaneous adduction of true vocal folds and/or supraglottic structures

# Continuous Laryngoscopy

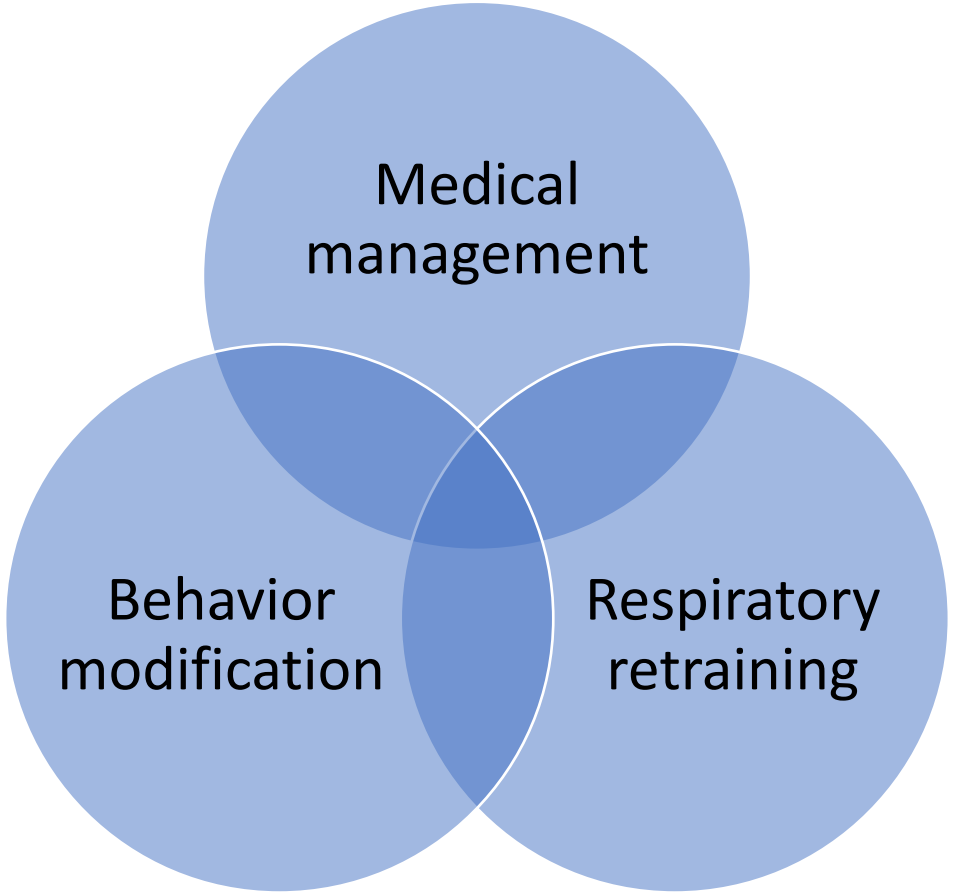


# Continuous Laryngoscopy

- https://www.youtube.com/watch?v=-a2eDhAm2q4
  - 3 minute video from National Jewish Health
  - Story of Lexi Beggan – Erie, Colorado
- Particularly important in the case of EILO
  - Individually-achieved peak work capacity
  - Symptoms often resolve within 60 seconds of activity cessation

# Treatment


Medical management
Behavior modification
Respiratory retraining

## Medical Management

- GER/LPR
- Allergies
- Asthma

## Behavioral Modification

- Tackle fear and avoidance
- Promote a healthy laryngeal environment

# Respiratory Training

- Identify maladaptive breathing patterns
- Replace with healthy ones (i.e., moving focus of breathing away from larynx)
- Build awareness of first indications of episode
- Teach and practice preventative and recovery breathing
- Expose to triggers
- Habituate reduced sensory response
- Address IMST/EMST if necessary

# Respiratory Treatment Components

- ✓ Training of Breathing Exercises
- ✓ IMST Devices

# BREATHING EXERCISES

- Three-Step Breathing
- The Olin EILOBI Breathing Techniques[4]
- Diaphragmatic Exercises[5]

# Resistance Testing - IMST/(EMST)

**Measurements taken:**
- **Baseline**
- **Any time athlete comes to therapy/change IMST**

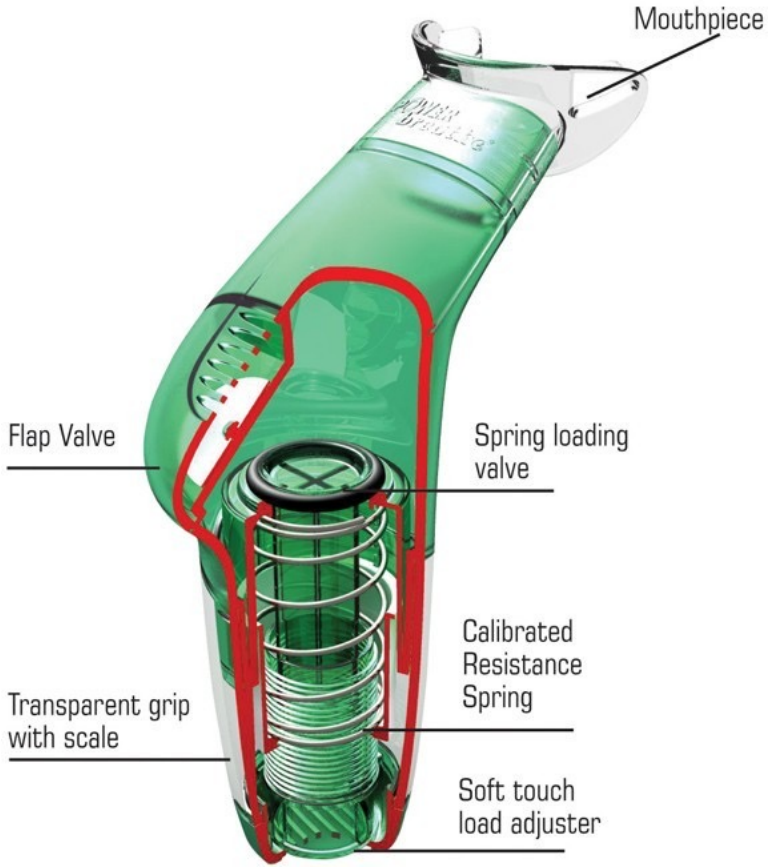
# RESPIRATORY MEASUREMENTS:

| Maximum Expiratory Pressure | TRIAL 1 | TRIAL 2 | TRIAL 3 | AVERAGE | NORMS |
|---|---|---|---|---|---|
| Men | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | 148 cm H2O |
| Women | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | 93 cm H2O |
| Boys | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | 96 cm H2O |
| Girls | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | 80 cm H2O |
| **Maximum Inspiratory Pressure** | **TRIAL 1** | **TRIAL 2** | **TRIAL 3** | **AVERAGE** | **NORMS** |
| Men | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | 106 cm H2O |
| Women | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | 73 cm H2O |
| Boys | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | 75 cm H2O |
| Girls | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | cm $H_2O$ | 63 cm H2O |

# RESPIRATORY TRAINING DEVICES

- **IMST**
  - **POWERBreathe**
  - **EMST-150/Inspiratory Adapter-150**
  - **Philips Respironics Threshold PEP & IMT**
  - **Acapella Vibratory PEP Device**
  - **The Breather**
- **EMST**
  - **EMST-150**

# POWERBreathe




# IMST Progression (PREs & Function)

- Inspiratory Muscle Strength Training
  - Set to 70% of the patient's maximum inspiratory pressure or the highest level the patient can tolerate
  - Patient completes:
    - 5 breaths through the device, 5 times per day
    - 5 days per week (take 2 days off)
    - For 4-5 weeks
    - Device setting is increased as the patient improves

**Progression with IMST**

1. Standing in Place
2. Gentle Walking in Place
3. Gentle Walking on the treadmill plus Step 1
4. Exercise on the Treadmill plus Step 1

# Weekly Home Practice Log

| Day | Set 1 | Set 2 | Set 3 | Set 4 | Set 5 |
|---|---|---|---|---|---|
| | □□□□□ | □□□□□ | □□□□□ | □□□□□ | □□□□□ |
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# Progress! Success!! Are we done??

- Would we be done with any other condition / injury?
- What else can we do to assist this athlete with return to sport?

# Return to Sport

- Functional Progression
  - Sport Specific
    - Position Specific
  - Identification of high-risk drills / activities

# Functional Progression

## Orthopedic Condition

- Intensity of activity
- Planned Vs Unplanned

## EILO

- Intensity of activity
- Planned Vs Unplanned

# High Risk Drills / Activities

- Functional Progression
  - Sport Specific
    - Position Specific
  - Identification of high-risk drills / activities
    - Intensity (Consequences and/or Pace)
    - Body Position (Vertical vs Horizontal)
    - Watch for patterns / ask the patient!

# Example: High School XC Athlete

- Excellent progression with breathing exercises
- Excellent progression with IMT
- Poor return to sport
- Functional Assessment
  - Correct technique
  - Functional progression
    - “Fartlic” training program for 3-step breathing
  - Development of Prophylactic Plan
- Excellent return to sport!

# Example: Collegiate Volleyball Athlete

- Excellent progression with breathing exercises
- Moderate progression with IMT
- Fear of return to sport
- Functional Assessment (discussion based)
  - Addressed fear issue
  - Identified specific drills that were “triggers”
  - Functional progression
    - VB specific activities
  - Development of Prophylactic Plan
    - Required discussion with coach and modification of drill selection for training program
- Able to return to sport!

# Example: HS Basketball Athlete

- Moderate progression with breathing exercises
- Excellent progression with IMT
- Poor return to sport
- Functional Assessment
  - Correct technique
  - Functional progression
    - Basketball specific defensive drills
  - Development of Prophylactic Plan
    - Adopeted “Dead ball” program or 3-step breathing
- Satisfactory return to sport!

# Examples from you:

## Sports:

- Soccer
- Football
- Wrestling
- other

## Goals:

- 1 to 3 controlled functional activities
- Progression of activities identified above
- Potential appropriate times for prophylactic use of breathing techniques during practice or competition?

# Questions?

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# Thank you