Respiratory Muscle Strength Training: How to get started

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Disclosures

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What is Respiratory Muscle Training?

• Training program which focuses on increasing the force-generating capacity of the expiratory or inspiratory muscles
  – Resistive devices
  – Pressure threshold devices

• For the sake of this presentation respiratory muscle training will not be other adjunctive respiratory or non-load producing devices
  – Deep breathing exercises
  – Incentive Spirometry
  – Cough assist
Resistive vs. Pressure Threshold Trainers

Resistive Trainers
• Narrow range of potential training (40 cmH₂O or less)
• Pressure load dependant on breathing pattern (flow)
  – Change in diameter of airflow vent holes
  – Potential for “cheating” – breathing at low flows
• No calibration

Pressure Threshold Trainers
• Spring loaded valve
  – Insufficient pressure → device won’t work
  – Training stimulus is independent of breathing pattern
• Variable calibration – ability to measure pressure

Respiratory Strength Training:
The basic steps

1. Evaluate your patient
   1. Swallowing and cough evaluation
   2. Include assessment of maximum expiratory and inspiratory pressures
2. Determine your targets for treatment
   1. Would this patient even benefit from respiratory muscle training?
3. Select a device
4. Develop a training program
   1. What load?
   2. What frequency of training?
5. Train your patient
6. Follow-up
Step 1: Evaluate your patient
Swallowing and Cough Evaluations

- Facemask in line with a pneumotachograph
- Irritant delivery port; Capsaicin
- Digitized (PowerLab) and recorded (Chart 7, ADInstruments) to laptop computer

Step 1: Evaluate your patient
Assess baseline respiratory muscle ‘strength’

Maximum inspiratory / expiratory pressures
Step 2: Determine your targets for treatment

- Improved maximum expiratory and/or inspiratory pressures
- Improved cough effectiveness
- Improved swallowing safety
- Vent weaning

(Wheeler et al., 2007; Wheeler-Hegland et al., 2008)

Step 2:
Does this patient need respiratory muscle training?

- Evaluation
  - No treatment
- Treatment
  - Compensatory
  - Modifications
  - Prosthetics
  - Rehabilitative/Restorative
  - Range of Motion
  - Strength
  - Coordination
  - Endurance
- Combined Modality
  - Compensation + Rehab
Step 2: Determine your targets for treatment

In order to save time

Functional Outcomes Associated with Expiratory Muscle Strength Training
Session 5657

Friday, Nov 21
11:00 am - 11:30 am

Presenter: Helena Laciuga

Multiple Sclerosis

Expiratory Muscle Strength Training in Persons With Multiple Sclerosis Having Mild to Moderate Disability: Effect on Maximal Expiratory Pressure, Pulmonary Function, and Maximal Voluntary Cough

Chiara et al., 2006; 2007

Expiratory muscle strength training
• EMST increased MEP and peak expiratory flow
• Improvement in maximal voluntary cough only occurred in subjects with a moderate level of disability
• No changes in voice with EMST

Chiara et al., 2006; 2007
Sedentary Elderly

Effect of expiratory muscle strength training on elderly cough function

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^Department of Speech Pathology, School of Nursing, Konkuk University, Seoul, Korea
&Department of Communication Sciences and Disorders, School of Allied Health Professions, University of Florida, Gainesville, FL, USA

Expiratory muscle strength training
• Improved maximum expiratory and inspiratory pressures
• Improved reflex cough effectiveness

(Kim et al., 2009)

Parkinson’s Disease

Aspiration and swallowing in Parkinson disease and rehabilitation with EMST: A randomized trial

Impact of Expiratory Muscle Strength Training on Voluntary Cough and Swallow Function in Parkinson Disease*

Teresa Pitts, MA, Donald Boler, PhD, John Rasminsky, PhD,
Michelle Troche, MA, Michael S. Olson, PhD, and Christine Sapienza, PhD

Expiratory muscle strength training
• Improved swallowing safety measured by PA scale
• Improved displacement of the hyoid during swallowing
• Improved SWAL-qol scores
• Improved voluntary cough effectiveness
• Improved maximum expiratory and inspiratory pressures

(Troche et al., 2010; Pitts et al., 2009)
Mechanically Ventilated Patients

Inspiratory muscle strength training improves weaning outcome in failure to wean patients: a randomized trial

Martin et al. Critical Care 2011. 15(1):4
http://ccforum.com/content/15/1/4

Inspiratory Muscle Strength Training
- Maximum inspiratory pressures increased ~10cmH2O
- No adverse events in IMST or SHAM group
- A higher proportion of patients on IMST weaned from MV

(Martin et al., 2011)

Ongoing work...

- Multiple Sclerosis (Sapienza et al.)
  - Swallowing and cough outcomes
- Stroke (Hegland et al.)
  - Swallowing and cough outcomes
- Amyotrophic Lateral Sclerosis (Plowman et al.)
  - Swallowing and cough outcomes
Step 3: Select a device

<table>
<thead>
<tr>
<th>Inspiratory Devices</th>
<th>Expiratory Devices</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>PowerBreathe</td>
<td>EMST 150</td>
<td>Power Lung</td>
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<tr>
<td>Threshold IMT</td>
<td>Respironics Threshold PEP</td>
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*I do not endorse any one specific product

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Step 3: Developing the training program
What load and frequency of training?

<table>
<thead>
<tr>
<th>Reference</th>
<th>Expiratory load (% MEP)</th>
<th>Number of repetitions per session/duration</th>
<th>Frequency (days per week)</th>
<th>Duration (weeks)</th>
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<tbody>
<tr>
<td>Weiner et al., 2003 a, b</td>
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<td>30 min</td>
<td>6</td>
<td>13</td>
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<td>Chiara et al., 2006</td>
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(Slide credit: H. Laciuga)
Step 5: Train your patient

Expiratory Training
1. Maximum inhalation
2. Open Mouth
3. Place Device Into Mouth, behind the teeth
4. Tight lip seal
5. Exhale forcefully through the device

Inspiratory Training
1. Maximum exhalation
2. Open Mouth
3. Place Device Into Mouth, behind the teeth
4. Inhale forcefully through the device

Step 5: Follow-up

Some questions:
• How often should I check in on my patient?
• How long should my patient train?
• Are there any data on maintenance or detraining effects?
Step 3: Follow up
How often should I check in on my patient?
How long should my patient train?

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(Slide credit: H. Laciuga)

20 Week Patient:
Maximum Expiratory Pressures
Detraining: *PA Score and MEPs*

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<tr>
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<th>Baseline PAS</th>
<th>Post Detrain PAS</th>
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<tbody>
<tr>
<td>No change</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Worsened</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Improved</td>
<td>2.5</td>
<td>1.5</td>
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(M MEP) 102.36 119.4  p=.033  p=.059 (Troche et al., 2014)

**RMST is not a *ONE SIZE FITS ALL* Therapy Program**

Adjustments may include (but are not limited to):

- More intensive training for patient
  - More days with therapist/week
  - More weeks
  - Training on “blowing” without resistance and completion of the EMST task, specifically

- More intensive involvement and training of caregiver

- Combination with compensatory or other restorative behavioral swallow-specific therapeutic technique
What are some of the main benefits?

- Functional Change
- Physiological Bases
- Improvement in Quality of Life

- Cost effective
- Ease of use
- Time efficient
- Concurrent feedback independent of clinician
- Reduced patient/caregiver/clinician burden
- Consistent use within and across visits/patients

Practical Cases
Thank You!

Upper Airway Dysfunction Lab

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Michael Okun, MD
John C. Rosenbek, PhD
Paul Davenport, PhD

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