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Respiratory Muscle Strength Training and Speech-Language Pathologists: Part 2
Denise Dougherty, MA, SLP

Moderated by:
Amy Hansen, MA, CCC-SLP, Managing Editor, SpeechPathology.com

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Respiratory Muscle Strength Training and Speech Pathologists Part 2

Denise Dougherty, MA, CCC-SLP
• **Presenter Disclosure:** Financial: Denise Dougherty was paid an honorarium by SpeechPathology.com for this presentation. She owns/operates a private practice in Pennsylvania. Nonfinancial: Denise has no relevant nonfinancial relationships to disclose.

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Learning Outcomes

As a result of this course, participants will be able to:

- List tools available for RMST.
- Describe the protocols for treatment for inspiratory and expiratory muscle strength training.
- Identify contraindications for treatment.

Course Description

- Part two discusses available tools to use for RMST. Protocols for inspiratory and expiratory muscle strength training will be reviewed as well as contraindications for use.
Cardiorespiratory System (6)

- Respiratory Circuit
  - lungs, airways, pulmonary vasculature
- Cardiac Circuit
  - Heart and systemic circulation
- Regulatory elements ensure adequate blood oxygenation during rest and exercise, while integrating systemic and pulmonary circulations
- Pharmacological interventions may briefly alleviate symptoms but won’t solve problem
- Only intervention that makes a long-term difference
  - RMT for inspiration and expiration
Tools Patients May Use

Incentive spirometer

- Provided to pts. after surgery or admission w pulmonary diagnosis

Positive Expiratory Pressure devices - PEP

- Provided to pts. w pulmonary conditions
- Assists w clearance of secretions

Respiratory Muscle Training – IMST, EMST, Breather

- Provide complete resistance respiratory muscle strength training, like skeletal muscle training

Incentive Spirometer (1)

- Helps lungs recover after surgery or lung illness
  - become weak after prolonged disuse.
- Conflicting results on benefits - some evidence
  - Improves lung function
  - Reduces mucus buildup
  - Strengthens lungs during extended rest
  - Lowers chance of lung infections

Used w permission TalkTools
Incentive Spirometer

- Sustained maximal inspiration or SMI
- Part of bronchial hygiene tx
- Mimic natural sigh/yawn by encouraging pt. to take long, slow, deep breaths
- Provides biofeedback when inhalation sustained for min. of 3 sec.

Objectives
- Increase transpulmonary pressure inspiratory volumes
- Activate inspiratory muscles to some extent
- Reestablish or simulate normal pattern of pulmonary inflation

Incentive spirometer

- Does not provide RM strength training
- No workload on muscles during inspiration
- Prevents post operative complications after surgery
- Effectiveness not supported by evidence

Guidelines changing
- Moving away from spirometer to prevent post op pulmonary complications
PEP

- Breathe thru mouthpiece or mask
- Air flows freely on inhalation then exhale against resistance
- Exhalation against resistance takes about 4 times longer than inhalation

Benefits

- Improve airway clearance
- Air gets behind mucus and assists in moving it out of lungs and airway
- Assists in keeping airways open
- Some devices have additional oscillatory function to improve mucus mobilization or OPEP

Flutter – Aptalis Pharma*
Acapella Flutter Valve – Smiths Medical*
Aerobika OPEP – Monaghan Medical*
V-PEP – D R Burton Healthcare Products*
Pari O-PEP – Pari Respiratory*
RC-Cornet*
Oscillating PEP

- Vibrations created with exhalation moves mucus from surface of airway
- Mimics beating of cilia
- After blowing through device several times, huff and cough to clear mucus from lungs (2)

Flutter

- Mucus clearance device
- Therapy administered in two stages:
  - Mucus loosening and mobilization
  - Mucus elimination
- Steel ball rolls up/down cone causing air flow vibration
- Gets air behind mucus and moves it from lung, airway walls
- Mimics cilial beat frequency
- Tx ends when no more mucus can be expectorated (3)(4)
Acapella Flutter Valve

- Steel ball near valve
- As pt. breathes into device, ball rattles against valve causing vibrations
- Helps loosen secretions from airways to cough up
- Creates back pressure
- ‘Pop’ alveoli open, helps treat/prevent atelectasis (collapse/closure of lung, alveoli don’t inflate, reduced or absent gas exchange) (5)

Acapella DM Blue

- Less difficult
- For pts. that generate expiratory flow of <15 L/min.
Acapella DH Green

- More difficult
- For pts. that generate expiratory flow of >15 L/min

RC-Cornet

- Facilitates airway clearance
- Exhalation
  - Positive exhalation pressure widens airways
  - Reduces respiratory distress
- Mobilizes bronchial mucus
- Exhaled air used to cleanse airways (3)
Assessments to Document RMW in PT, OT, ST

- Breathing pattern
- Cognitive level
- Borg Scale
- Ventilatory Response Index – VRI
- Maximum phonation time MPT
- Timed up and go TUG
- Swallow function/voice quality
- Vital monitoring

Cognition

- Assess cognitive level - baseline
- Not uncommon for pts. to experience exacerbation of cognitive deficits when pulmonary system is compromised
- Link between respiration, cognitive functions, oxygenation
Allen Cognitive Diagnostic Module (7)

- Occupational Tx
- 35 standardized activity assessments of functional cognition
- Objective measure of cognitive function, develop goals based on what pt. CAN do
- No cognitive level where RMT would be excluded

Dyspnea Scales

- Multiple versions to score shortness of breath during exercise or tasks
- Borg scale Rating of Perceived Exertion (8)
  - Scale from 6 to 20
  - 6 = "no exertion at all" and
  - 20 = "maximal exertion."
  - # that best describes individual's level of exertion during physical activity
  - Also a modified scale 0-10
VRI or Ventilatory Response Index (9)

- Level 0 - count to 15 in 8 sec. in 1 breath
- Level 1 – must take 1 breath during count to 15 in 8 seconds
- Level 2 – must take 2 breaths during count to 15 in 8 seconds
- Level 3 – must take 3 breaths during count to 15 in 8 sec.
- Level 4 – must take 4 breaths during count to 15 in 8 sec

Simple and easy to use – assess phonatory mechanics

- MPT – longest period during which a pt. can sustain phonation of vowel sound – typically /a/ used

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Tug Test – Times up and Go Test (10)

- Pt w typical footwear, use typical device
- Sit in standard armchair –line on floor 10 ft away from pt.
- "When I say GO I want you to….
- stand up from chair
- walk to line on the floor at your normal pace
- turn
- walk back to chair at your normal pace
- sit down again

Record time in seconds from GO until pt. returned to seated position

Observe

- Slow tentative pace, loss of balance, short strides, little or no arm swing, steadying self on walls, shuffling, not using assistive device properly
- breathing pattern, hurried gait to beat running out of air
- Older adult who takes >12 seconds to complete TUG is at high risk falling
Swallow

- Traditional Bedside Dysphagia Eval
- Coordination of respiration/swallow
- Breathing during swallow because they are unable to complete swallow before they need next breath?
- Ability to produce protective cough if airway protection is needed.
- Pt’s endurance for adequate PO intake

Voice

- Note vocal quality
- Compromised respiratory function w
- Reduced power for voicing may overcompensate by increasing laryngeal tension,
- Speaking on residual air
- Fading voicing capacity as day progresses
- Experience limited verbal communication w even light activity
Train Diaphragmatic Breathing for RMT

- Increased breathing efficiency w improved coordination of respiratory muscles and oxygenation
- Helpful to learn technique supine w HOB elevated at 30-40 degrees
- Breath in thru nose, abdomen pushes out; breathe out thru pursed lips & abdomen falls as it relaxes
- Place hand on abdomen to watch/feel it rise
- Diaphragm used for efficient respirations
- Increase depth of respiration
- Progress w adding technique to standing, ADL's, ambulation

Diaphragmatic Breathing

- Train diaphragmatic breathing before RMT
- Want diaphragmatic breathing for efficiency
- Must have this down before beginning RMT
- Raising chest and shoulders when breathing takes more energy, less efficient
- Tend to breathe like this when we’re tense
- SOB makes us tense so it becomes a cycle
- Get most oxygen w least amt. of effort
Respiratory Muscle Training  (6)

- Protocols depend on device used and underlying disorder
- Generally….
- Improving respiratory muscle strength requires regular RMT for at least 3 wks. to observe significant effect
- Training intensity should be moderate to high
- At 50-70% of maximal inspiratory or expiratory pressure
- Typically 1-2 times/day, at least 5 days per week

Lightheaded w RMT?

- Almost everyone gets lightheaded, feel they are hyperventilating
- Need to adjust to increased oxygen and carbon dioxide exchange
- May take 1-2 wks. to subside
- Pause for several minutes, breathing normally, then continue
- If lightheadedness persists, stop and contact your care provider
Coughing w RMT?

- May cough d/t required force working against resistance while exhaling
- Great for airway clearance, so don’t try to suppress it.
- Remove tool until finished coughing.
- Expel any phlegm, secretions rather than swallow

Breather (11)

- First RMT device
- Peg Nicholson invented – “PN” Medical
- Inspiratory and expiratory muscle strength trainer

(q7) (q8)
Breather

- Increases muscle strength with resistance training
- Breathing against resistance activates/strengthens respiratory muscles
- Load muscles with workload and they become stronger (11)
Breather

- Careful evaluation recommended before initiation if:
- active hemoptysis, untreated pneumothorax, esophageal surgery, airway stenosis (true vocal fold mass, vocal fold paralysis in adducted position, subglottic stenosis, etc.), intracranial pressure > 20mm Hg, recent oral, facial or skull trauma / surgery, acute sinusitis, epistaxis, hemodynamic instability, bolus emphysema, tympanic membrane rupture or middle ear pathology (11)

Protocol (11)

- Inhale Settings
  - 1-6

- Exhale Settings
  - 1-5
Protocol

- Rotate dials to setting
  - manage 10 breaths without puffing cheeks or getting out of breath
- Feel like you’re giving 70% effort to get to 10th breath
- Independently increase settings if set of 10 breaths become too easy
- 6 days per week, 2 sessions per day – morning/evening
- 2 sets of 10 full breaths each session
- Session log on website

How do you know when to increase resistance?
- Puffing cheeks – resistance too high or lightheaded
- % of effort is low, bump up and try next level
- Clinical judgment comes into play

- Pt. w trach?
  - Sure – use clinical judgment
  - Tolerate finger occlusion for verbalization?
  - Finger occlude w breather – easy to take hand off if panicky or SOB
  - Great way to work towards Passey Muir, cap trach, eventual discharge trach
Calming Intervention

- Breather as calming intervention
- SOB increases tension
- Turn breather to lowest setting – breath easily through mouthpiece
- Focus on relaxing
- When anxious – use at lowest setting to get breathing under control again

Breather Fit

- Professional athletes, entertainer, professional voice users
- Extend time to fatigue
- Improve cardio performance
- Reduce exercise limiting dyspnea
- Extend lactate threshold – measure to decide exercise intensity in endurance sports
- Strengthen diaphragmatic muscles
EMST 150, 75 Lite

- Pressure threshold handheld calibrated device
- One-way spring-loaded valve
- Adjustable external dial
- Valve blocks flow of air until enough pressure produced
  - Valve won’t open if expiratory force is inadequate
- Valve open and air flows
- Adjust pressure amount
- Range between 24-150 cmH20
- Work at 75% of pt.’s MEP and increase each week (12)
EMST 150 and EMST 75 Lite

- Check w physician before using if
  - Suspect pregnancy
  - Untreated hypertension
  - Recent stroke
  - History of collapsed lung
  - Recent head/neck surgery
  - Untreated gastroesophageal reflux disease (12)

- Turning knob clockwise tightens spring
  - More difficult to blow air out through valve
- Turning counterclockwise loosens spring
  - Easier to blow air out through valve
EMST 150

- Find maximum expiratory strength
- Turn knob – small metal screw at 30
- Take deep breath in, insert EMST mouthpiece in mouth, blow quickly through device until air rushes through and stop

EMST 150

- Easy?
- turn knob clockwise one full turn and repeat
- Unable to move air through?
- turn ¼ turn back or counterclockwise
- continue until you can move air through
- This is your MAX. pressure
- Train 1st wk. at ¼ turn below max pressure
Protocol

- 5 sets of 5 breaths = 25 training breaths
- Rest for 15-30 second minimum between breaths
- Rest for 1 minute between sets
- 5 days a week with 2 rest days
- 5 weeks
- Each week – weeks 2-5
- Turn knob ¼ turn clockwise and train
- Maintenance Training
- 3 days a week, 25 breaths
- 5 sets of 5 breaths

EMST 75 Lite

- Builds breath power
- Lower thresholds for training
- 5-75 cmH20
- Increase strength of expiratory muscles
- After reaching 75 cmH20 may continue with EMST150
EMST 75Lite

- Turn knob counterclockwise until can’t turn any longer
- Take deep breath in, insert EMST mouthpiece in mouth
- Blow quickly through device until air rushes through, then stop
- Follow same steps as for EMST 150

Inspiratory Adaptor

- Turn knob until small metal screw lines up w 30
- Insert EMST 150 into IA 150
- Deep breath in, push all air out of lungs
- Insert IA 150 mouthpiece in mouth
- Inhale forcefully
- Too easy? Turn knob ½ turn clockwise and repeat
- Too hard? Turn knob back ½ turn
IA Protocol

- 5 sets of 5 breaths = 25 training breaths
- 5 days a week w 2 rest days
- 5 weeks

Maintenance
- 3 days a week, 25 breaths
- 5 sets of 5 breaths

End of week 1
- Remove IA 150, increase pressure on EMST 1/8 to ¼ turn clockwise
- Use silver screw as guide

Before Meal?

- Improve cough – need strong expiratory muscles but need inspiratory muscles to draw air in first

- Some pts w dysphagia may prefer to only train exp muscles before meal to be able to effectively cough something out

- Maybe 2 sets of 5 before meal
Monitor!

- Pulse Oximeter
- Monitor for any changes
- Make sure device is cleaned properly
- Device is PATIENT SPECIFIC

Discharge Planning

- Pts less likely to decline if aftercare or some type of discharge plan in place
- Home Exercise Plan HEP
- Restorative Nursing Program RNP
- Functional Maintenance Plan FMP
- Caregiver/Staff education
- Maintain skills they’ve gained
Restorative Nursing - Skilled Nursing Resident

- Restorative nursing program or RNP would be appropriate for discharge in Skilled Nursing setting
- Can be adapted to nursing Functional Maintenance Plan or FMP following restorative services
- Can function as a home exercise program or HEP for pts able to independently complete RMT
- Template for restorative nursing plan or home exercise program

Therapy – Group or Concurrent

- Group – 2-6 pts. at one time doing same or similar activities supervised by one therapist/therapy assistant
- Concurrent therapy – tx of 2 pts. at one time doing different activities supervised by one therapist/therapy assistant
- Can’t be more than 25% of pt's total treatment minutes
- Pts benefit from encouraging, supporting each other within group
- RMT can be done concurrent
Home Health?

- Improve home health pt. outcomes
- Decrease risk of re-hospitalization
- Provide cost effective solution for carryover of home exercise program
- Measurable data to include in OASIS
  - ADL's fall risk, neuro/emotional/behavioral status
  - Pt not as anxious d/t SOB
- Many re-hospitalizations d/t respiratory issues
- Whole team promoting, supporting use of device, but one discipline takes lead

So......RMT......

- Cost effective intervention improves pt. outcomes
- Evidence based approach
- Decreased risk of re-hospitalization d/t exacerbation of symptoms
- Benefits pts. treated by all disciplines
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