Innovative Approach to Osteopathic Treatment for COPD Patients

Harriet H. Shaw, D.O. & Bruce Benjamin, Ph.D.
Oklahoma State University CHS

Objectives/Topics

• Describe basic features of COPD
• Describe changes in mechanics with COPD
• Review the 5 Osteopathic Treatment Models
• Apply aspects of each model to COPD
• Describe the importance of heart rate variability, arterial pressure variability and respiratory variability in health and disease
• Explore the effects of biomechanics on ventilation perfusion & breathing patterns
• Describe how OMT could improve quality of life in COPD patients

Features of COPD

• Smoking - most common cause
• Mucus accumulation
• Increased respiratory effort
• Inflammatory changes
• Less efficient cilia
• Secondary infections
• Increase O₂ utilization
• Fatigue & activity restriction
• Expected to be 4th leading cause of death by 2020
Features of COPD

- Thoracic cage expands
- Diaphragm flattened
- Increase kyphosis
- Overuse accessory muscles
- Chronic cervical & thoracic pain
- Pain & TTA widespread (cervical & thoracic)
  - Viscerosomatic
  - C3-5 (phrenic) SD effect diaphragm function

Exercise Intolerance in COPD

- Most frequent complaint—exercise intolerance
  - Isolation
  - Depression
  - Lack of exercise
- No medical cures
- Abnormal skeletal muscle function may contribute to exercise intolerance
- Pulmonary Rehab (exercise training, education, psychological counsel, nutrition)

OMT for COPD

- OMT anecdotally offers improved exercise tolerance & well being in COPD patients
- Numerous outcome studies
  - Various OMT interventions
  - Most measure FEV₁ & FVC with varying results
  - All measures immediately post intervention
  - Almost all patients reported beneficial effects
    - Well being
    - Performance of daily activities
Pilot Study—OMM for COPD

- Zanotti, et al, 2012 compared effects of combining OMT with PR (G2) vs PR with sham (G1)
- 20 pt with severe COPD
- Sham=soft tissue manipulation
- VC, FVC, FEV1 & RV—G2 ↓ RV (no other signif ▲)
- 6MWT/Borg scale breathing & fatigue—both G1 &G2 improved—G2 significant more

Breathing Patterns & Chest Wall Restriction

- Poor biomechanics of chest wall movement
- Weak respiratory muscles
- V/Q mismatch
- Poor ventilation
- Breathing patterns as reflection of work of breathing
- Systems coupling significant consideration in tx

Osteopathic TX--5 Interacting Models

- Five models that articulate how an osteopathic practitioner seeks to influence a patient’s physiological processes.
  - Glossary of Osteopathic Terminology (AACOM)
  - Foundations for Osteopathic Medicine (AOA)
  - Principles of Manual Medicine 3rd ed. pp 5-10 (Greenman)
Neurologic

- Viscerosomatic reflexes for lungs
  - T1-6 (SNS)
  - OA (Vagus - PNS)
- C3-5 phrenic nerve origin to diaphragm
- Tx: balance SNS-PNS & reduce neurogenic inflammation
- COPD pt: pain in thoracic and cervical areas

Respiratory/Circulatory

- Respiratory Excursion
  - Rib dysfunction
  - Thoracic cage mobility
  - Diaphragm movement
- Venous & lymphatic impact on
  - Immune response
  - Inflammation
  - Edema/Congestion
- V/Q match
Metabolic/Energy

• Increased energy expenditure
  – Accessory muscles
  – Work of breathing
  – Somatic dysfunctions

• Endurance
  – Functionality
  – ADL
  – Fatigue

• Loss of skeletal muscle mass in chronic pulmonary ds.
  – deconditioning

Behavioral

• Smoking cessation
• Allergens/Pollutants
• Medication compliance
  – Inhaler education
• Hydration
• Exercises

Biomechanical

• Rib cage mobility
• Spinal mobility
  – Thoracic kyphosis/pain
• Diaphragm
  – Lower ribs
  – Upper lumbar
• Accessory respiratory m.
  – Cervical attachment
  – Upper extrem. attachment
  – Other soft tissue (pect. etc.)
• Decreased bone density
The dynamic & interactive nature represented by these osteopathic treatment principles could be a window to analysis of complex systems.

Osteopathic Considerations for Patients with COPD:
A New Perspective
Bruce Benjamin, Ph.D.
Oklahoma State University, Center for Health Sciences

Complex System
Dynamic System Analysis
Areas of Study

- Diffusion
- Mechanics
- Pulmonary Blood Flow
- Alveolar Ventilation
- Ventilation /Perfusion
- Cardiopulmonary Integration

Hypothesis: Uncoupling of Biological Oscillators

Patterns

- Next 3 slides show how patterns of heart rate, blood pressure, and respiration provide physiological information
Patterns are Important

Example Blood Pressure

COPD

Pulmonary Fibrosis

Chronic Anxiety
Control System

- Brain
- Lungs
- Chest wall
- Sensory afferent nerves
- Efferent nerves

Mechanics

- Think of two components
  - Bony, moderately flexible rib cage
  - Elastic lung
- How will these components impact lung function?
Mechanics-Functional Implications

Functional Residual Capacity

Emphysema/COPD Study

- Observations from practicing physicians document that patients with emphysema/COPD benefit from OMT
- What is the mechanism?

Features of COPD

- Thoracic cage expands
- Diaphragm flattened
- Overuse accessory muscles
- Increased work of breathing
  - Increased respiratory effort
  - Increased O₂ utilization
  - Fatigue & activity restriction
  - Changed mechanics and pattern of Ventilation
  - Ventilation/Perfusion mismatch
Smoking – Lung injury

- Increased: Lung Compliance, Dynamic Compression, Airflow Obstruction, Air Trapping, Lung and Chest Cage Volume,
- Decreased: Chest Cage Mechanics and Compliance, Diaphragm Mechanics and Compliance, Respiratory Variability, Intrathoracic Pressure Gradient
- Increased: Total Body and Pulmonary Work Load
- Decreased: Ventilation/Perfusion
- Decreased: Gas Exchange
- Increased: Oxygen Consumption

Exercise tolerance ↓

Hypothesis

- Increased: Lung Compliance, Dynamic Compression, Airflow Obstruction, Air Trapping, Lung and Chest Cage Volume,
- OMT
- Improved: Chest Cage Mechanics and Compliance, Diaphragm Mechanics and Compliance, Respiratory Variability, Intrathoracic Pressure Gradient
- Decreased: Total Body and Pulmonary Work Load
- Increased: Ventilation/Perfusion
- Increased: Gas Exchange
- Decreased: Oxygen Consumption

Exercise tolerance ↑

Forced Vital Capacity

Only part of the story
Rib Cage and Abdominal Movement

Healthy

AB

COPD

RC

COPD: after DMT

AB

Dynamics Change when Mechanics Change

Breathing Pattern Examples

Normal

Cheyne-Stokes

Normal: Sigh
Summary

• We have learned much from the traditional perspective of mechanics and respiratory function.
• New approaches using nonlinear dynamics (patterns) have opened the door to approach respiratory physiology from a new perspective.
• In the future this will impact diagnosis and treatment of patients.