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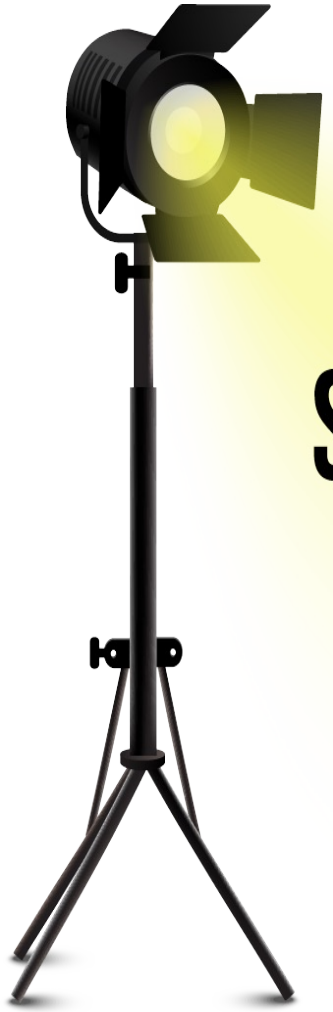


SPOTLIGHT *Series*

"Let's Just Take a Deep Breath": Understanding Pulmonary Function Tests (PFTs) and the Clinical Relevance to Obstructive vs. Restrictive Pulmonary Diseases

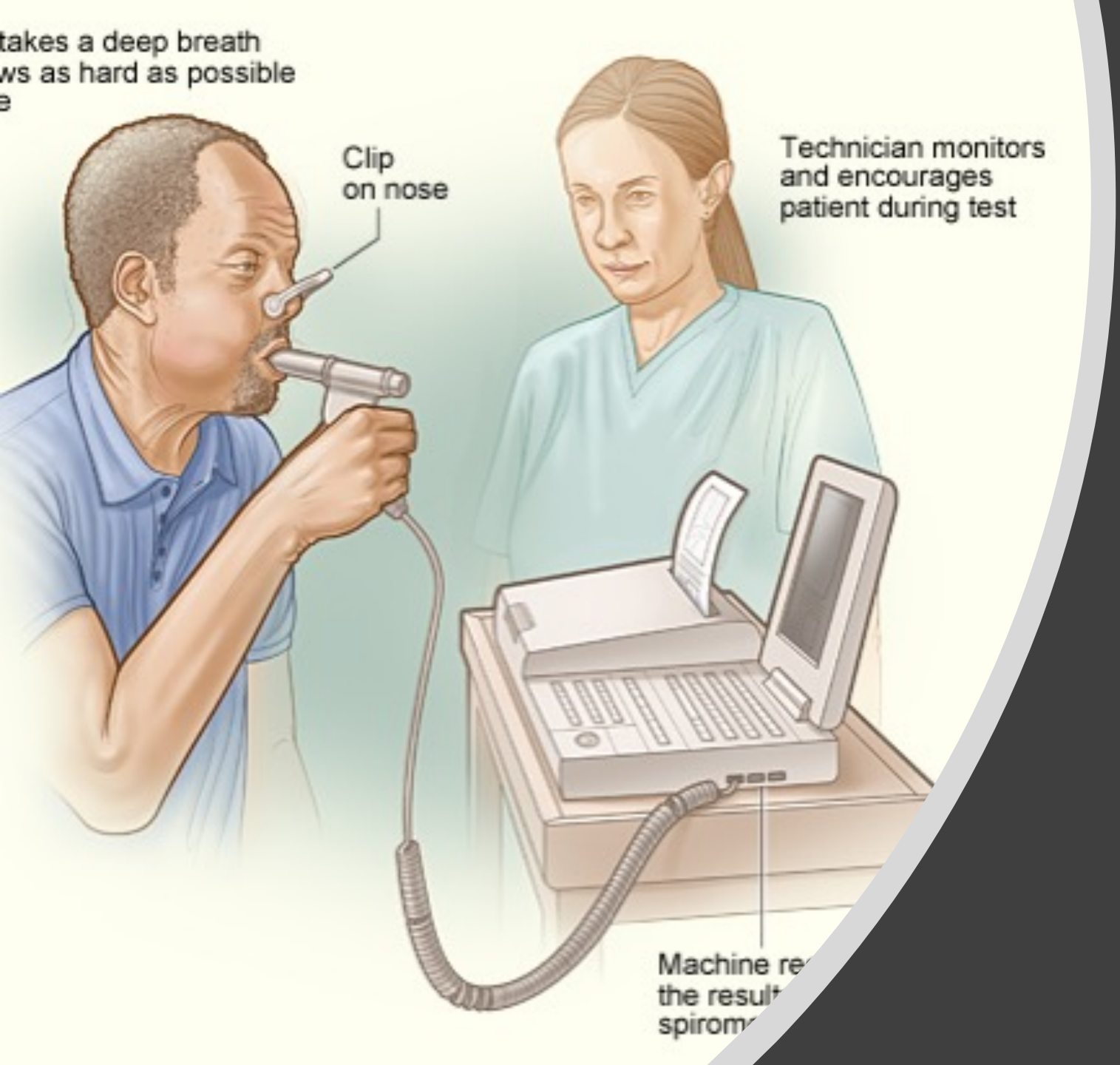
Presented by Holly Daniel, PT

Objectives

- Discuss the values we gain from PFTs
- Recognize the difference between lung volumes, capacities, and flow rates
- Correlate PFT findings to relevant pulmonary diseases
- Briefly discuss other tests/measures and interventions associated with pulmonary diseases

Habit 5: “Seek First to Understand, Then to Be Understood”

- The 7 Habits of Highly Effective People
- First published in 1989
- Written by Stephen Covey
- New York Times Bestseller for 5 years



Pulmonary Function Test (PFT): Use of spirometry is most common

Recent Question (3/30/22) in PT365 App

A physical therapist examines normative values for lung volumes prior to performing pulmonary function testing on a patient. Which of the following lung volumes would typically have the **GREATEST** value?

1) Tidal volume
2) Inspiratory reserve volume
3) Expiratory reserve volume
4) Residual volume

(47%; 38%; 10%; 5%)

Lung Volumes Measured with PFTs

- Tidal volume (TV) = 10% of total volume
- Inspiratory reserve volume (IRV) = 50% of total volume
- Expiratory reserve volume (ERV) = 15% of total volume
- Residual volume (RV) = 25% of total volume

Lung Capacities Measured with PFTs

TV + IRV = Inspiratory Capacity (IC) = 60%

TV + IRV + ERV = Vital Capacity (VC) = 75%

ERV + RV = Functional Residual Capacity (FRC) = 40%

TV + IRV + ERV + RV = Total Lung Capacity (100%)

Flow Rates (Speed of Exhalation)

Forced Vital Capacity (FVC) = Amount of air exhaled forcefully & quickly after inhaling as much as you can

Forced Expiratory Volume (FEV) = Amount of air exhaled during the first, second, and third seconds of the FVC test

Forced Expiratory Volume in the First Second (FEV_1) = Clinical marker for severity of chronic obstructive pulmonary disease (COPD)

FEV_1/FVC Ratio = FEV_1 expressed as a percentage of the FVC (clinical index of airflow limitation); FEV_1/FVC = 70-80% in normal adults; FEV_1/FVC < 70% is a primary indicator of an obstructive impairment

Peak Expiratory Flow (PEF) Rate

Maximum flow of air (flow rate) generated during a forced expiratory maneuver

PEF can be measured on a regular basis (e.g., daily) using a handheld peak flow meter to track a patient's pulmonary status

Comparing daily peak flow rates to patient's "best" test value may help determine if physician visit and/or change in medication might be needed

Size & Configuration of Thorax Influences Lung Volumes, Capacities, and Flow Rates

Height: As height increases, lung volumes also increase

Gender: Adult female lungs are typically ~ 10% smaller than lungs of males (similar height & age)

Any change in the properties of the lungs or chest wall (e.g., aging process, disease process) will also change lung volumes, capacities, and flow rates

Obstructive Lung Diseases

- Chronic Obstructive Pulmonary Disease (COPD)
- Asthma
- Cystic Fibrosis (CF)
- Bronchiectasis

PFT Findings with COPD

COPD refers to lung diseases (e.g., emphysema, chronic bronchitis) that block airflow due to narrowing of the bronchial tree, resulting in alveolar destruction and subsequent air trapping

Functional residual capacity (FRC) and RV increase from normal values due to air trapping

Expiratory flow rates (FEV_1) decrease; FEV_1/FVC ratio also decreases (< 70%)

FEV_1 used as indicator for severity of COPD (GOLD Classification): 50-79% of predicted = moderate COPD; 30-49% predicted = severe COPD; < 30% predicted = very severe COPD

Asthma

Asthma is an obstructive lung disease, but asthma is not COPD

Characterized by chronic inflammation of the airways caused by airway hypersensitivity to various stimuli (e.g., pollen, mold, dust, animal dander)

FEV_1 < 80% of predicted value during exacerbations; FRC and RV are increased due to air trapping during exacerbations; during remission, PFTs may be normal

PEF measurements are commonly used to help control or monitor asthma

Restrictive Lung Diseases

- Idiopathic Pulmonary Fibrosis (IPF)
- Acute Respiratory Distress Syndrome (ARDS)
- Sarcoidosis and Asbestosis
- Abnormalities of lung parenchyma (e.g., atelectasis, pulmonary edema)

Extrinsic Factors Associated with Restrictive Lung Dysfunction

Thoracic deformity (e.g., scoliosis, ankylosing spondylitis)

Muscle disease or weakness (e.g., myasthenia gravis, ALS, MD)

Other contributing factors: obesity, pregnancy, ascites

PFT Findings with Restrictive Lung Diseases

Reduction in VC, RV, and TLC

Expiratory flow rates (FEV_1) typically normal

FEV_1/FVC ratio typically normal (> 70%)

Additional Tests and Measures for Pulmonary Diseases

- Observation (use of accessory muscles of breathing; AP to lateral diameter of the thorax; perioral and periorbital skin color; nail beds)
- Vital signs (e.g., HR, BP, RR, temperature, and presence of pain)
- Oxygen saturation (SpO_2 vs. SaO_2) levels (pulse oximetry vs. ABGs)
- Auscultation of the lungs
- Baseline Dyspnea Index (BDI)
- 6-Minute Walk Test or 10-Meter Shuttle Walk Test
- Measurement of respiratory muscle strength (e.g., MIP, MEP)
- Exercise Tolerance Test (ETT)

Exercise Prescription for Pulmonary Dysfunction

FITT principle:

F = Frequency

I = Intensity

T = Time (duration)

T = Type (of exercise)

Other Pulmonary Interventions

- Pulmonary Rehab (multidisciplinary)
- General strength training; High-intensity interval training (HIIT)
- Ventilatory muscle training
- Secretion removal or airway clearance techniques (e.g., postural drainage, percussion, vibration)
- Breathing exercises (e.g., pursed-lip, diaphragmatic)
- Activity pacing and energy conservation
- Patient education

Practice Question

A physical therapist examines data from a patient's pulmonary function test. The patient's vital capacity was recorded as 5,000 mL. Based on the recorded value for vital capacity, which of the following values would be **MOST** representative of the patient's expected inspiratory capacity?

1) 1,000 mL
2) 2,500 mL
3) 4,000 mL
4) 6,000 mL

Just One More Practice Question

A physical therapist examines a patient diagnosed with chronic bronchitis. Which of the following methods would be the **MOST** appropriate to determine if the patient would benefit from airway clearance techniques?

1) Chest radiograph
2) Pulmonary function tests
3) Auscultation
4) Culture specimen

Conclusion

- Increased your confidence with understanding lung volumes, lung capacities, and flow rates (PFTs)
- Helped relate values gained from PFTs to lung diseases (obstructive vs. restrictive)
- Recommended methods of improving your retention of this knowledge so you can apply it

Questions?

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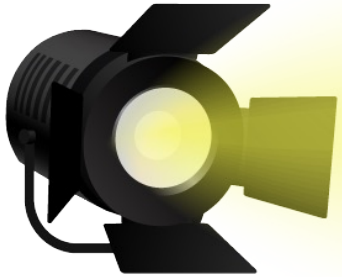
Feedback? Let Us Know!

We would love to get your general feedback on today's session and ideas for subject matter for future Spotlight Sessions!

info@scorebuilders.com



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Good Luck and Thanks for Tuning In!

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