


Let's Blow Up A Balloon!:
Breathing in Orthopedic Rehabilitation
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Breathe....

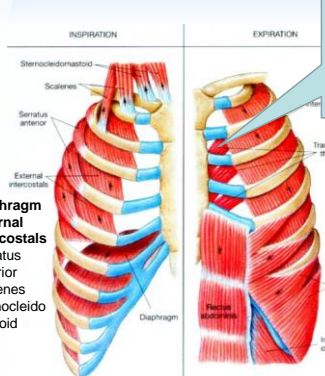
- ▶ Healthy adult: 12-15 breaths per minute
- ▶ 15/min x 60min x 24 hours = 21,600 breaths per day
- ▶ 7,884,000 breaths per year





Everyone Breathes Differently



- ▶ ...yet, we all are used to breathe similarly at birth!

- Diaphragm
- External Intercostals
- Serratus Anterior
- Scalenes
- Sternocleido mastoid
- Internal Intercostalis
- Transverse Thoracis
- Transverse Abdominis
- Resctus Abdominis



What Type of Breather Are You?


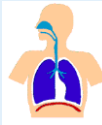


- ▶ Diaphragmatic
- ▶ Chest/Back
- ▶ Shoulder/Neck
- ▶ Good or Bad?



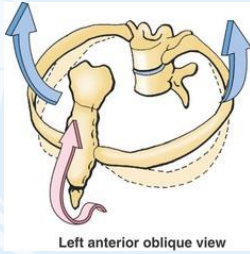



Diaphragm

- ▶ Dome-shaped muscle
- O:** Vertebral: crura from bodies of L1, 2 (left), L1-3 (right)
- Costal: cartilage of 7th-12th ribs
- Sternal: xiphoid process
- I:** Central Tendon
- A:** Contraction – Inhalation
Trunk stabilization¹⁻³
Relaxation – Exhalation
- N:** Phrenic nerve (C2-4)

Diaphragm and Rib Orientation^{4, 15}

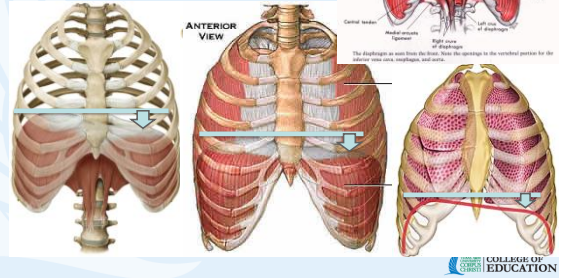


- ▶ Inhalation
 - Superior, anterior, lateral expansion
 - External rotation
- ▶ Exhalation
 - Inferior, posterior, medial movement
 - Internal rotation

Left anterior oblique view

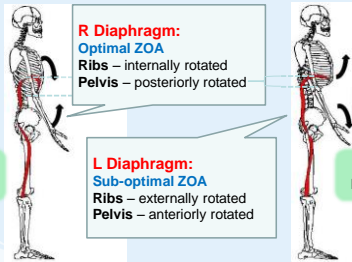
Notice Anything?

- Right diaphragm is **higher** than left!



Diaphragm and ZOA

- Zone of Apposition (ZOA)



State of Exhalation

State of Inhalation

ZOA - Visualized

- ▶ Watch for the **Left Rib Flare!** (sometimes bilateral)

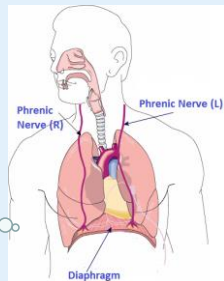


Diaphragm: Left vs Right

- Right-Left Difference

1. Neurally
2. Anatomically
3. Functionally

Innervated by a different nerve!



Diaphragm: Left vs Right

- Right-Left Difference

1. Neurally
2. Anatomically
3. Functionally

- R Diaphragm is given more mechanical advantage because of

- Liver
- Lungs (3 vs 2 lobes)



Diaphragm: Left vs Right

Right-Left Difference

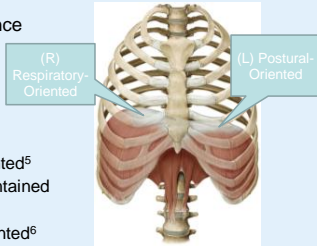
1. Neurally
2. Anatomically
3. Functionally

R Diaphragm

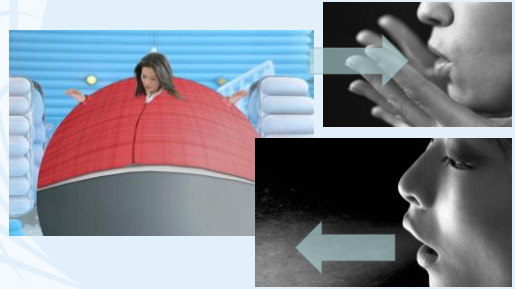
- Respiratory-oriented⁵
- Needs to be maintained

L Diaphragm

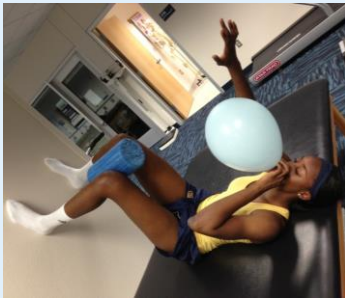
- Too postural-oriented⁶
- Needs to regain proper mechanical advantage to effectively contract



State of Hyperinflation^{5,7,8}



Let's Blow Up A Balloon!



Intro to Diaphragmatic Breathing

- ▶ Step 1: Be aware of your own breathing pattern
 - Breathe in through the nose, out through the mouth
 - As you breathe in and out quietly, palpate your anterior & posterior 1) neck, 2) chest, 3) abdomen and 4) lateral chest



Intro to Diaphragmatic Breathing

▶ Step 2: Learn how to EXHALE!

- Inhale through the nose
- Exhale strongly through mouth
- Hold a breath for 3-4 seconds
 - Place your tongue lightly against the roof of your mouth while pausing



Breathing in Different Positions



Intro to Diaphragmatic Breathing

- ▶ Step 3: EXHALE against a balloon

 1. Hold a balloon with the left hand
 2. Breathe in through your nose
 3. Exhale and blow up a balloon
 4. Hold a breath for 3-4 seconds
 - Do not pinch the balloon with teeth/fingertips
 - Pinch lightly with your lips and put your tongue on the roof of your mouth, stop the airflow
 5. Take another breath in through your nose
 - * Without opening the rib cage!
 6. Exhale and blow up again



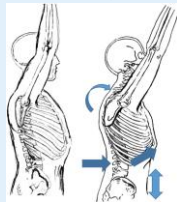
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Proper Breathing Can...

- ▶ Maximize the efficiency of the respiratory and postural roles of the diaphragm^{5,13}
 - Can indirectly treat many orthopedic conditions
 - LBP,^{9,10} Sciatica,⁹ Thoracic outlet syndrome,¹¹ Asthma¹²
- ▶ Promote relaxation¹⁴
- ▶ Improve ROM?



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