

# CONNECTING GROUND SENSE AND THE AIRWAY THROUGH ARM SWING

Louise Kelley, PT, DPT, PRC

## Purposes of arm swing

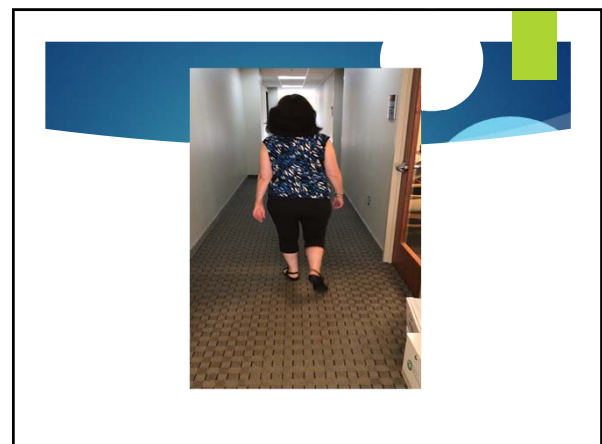
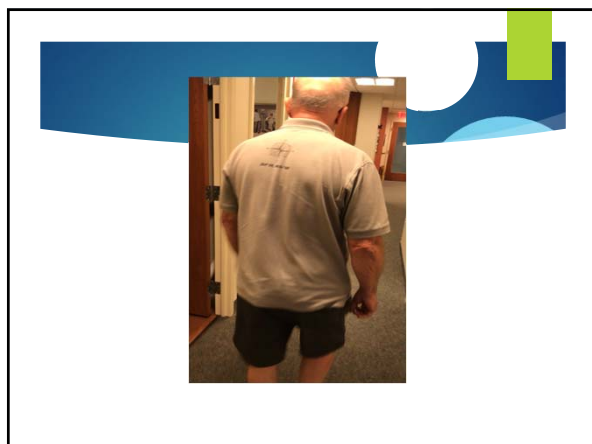
- Sets timing and rhythm of movement. When we walk, the legs follow the cues of the arms. (Meyns, 2013)
- Initiates pumping action of the respiratory diaphragm and expansion and compression of the ribs and lungs beneath to move fluid and air. (Bramble, 1989)
- Reduces torque on head and neck. Acts as a mass damper. (Pontzer, 2009)

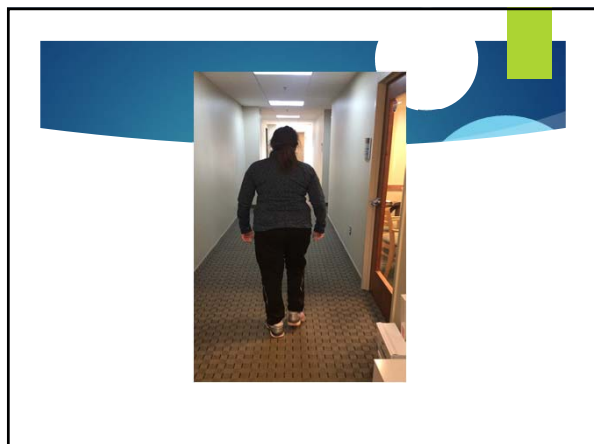
## Purposes of arm swing

- Balances angular momentum of pelvis. (Herr and Popovic, 2008; Romkes, 2017)
- Connects sensory input from above (visual, vestibular, gnathic) to sensory input from below (ground sense, peripheral proprioception) ...
- ... by its influence on cranial and jaw position and its influence on lateral displacement of our trunk over our pelvis, leg, and foot. (Bramble, 1989; Kim, 2020)

(Araiyo, 2015; Killeen, 2018; Leiwel, 2010; Plate, 2014)

Multiple studies have concluded that left arm swing amplitude is consistently greater than that of the right arm, regardless of handedness.





### Gunslinger's Gait: a new cause of unilaterally reduced arm swing

(Araujo, et al: BMJ: 2015)

A small, square thumbnail image showing a person walking, likely related to the 'Gunslinger's Gait' mentioned in the text above.

We are inherently asymmetrical.

Most evident in our brain and in our respiratory diaphragm.

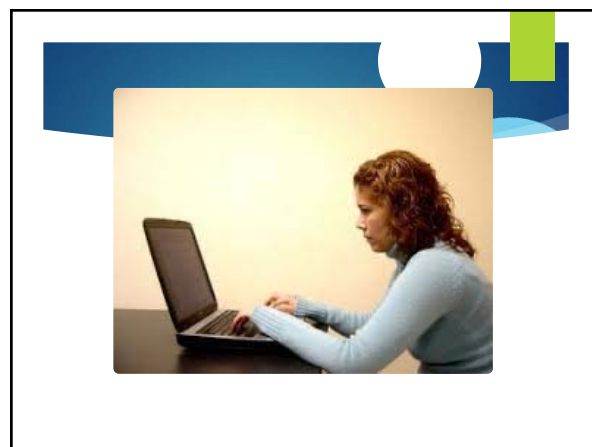
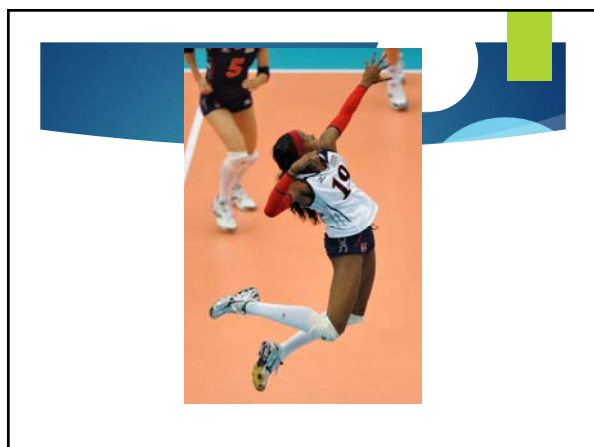
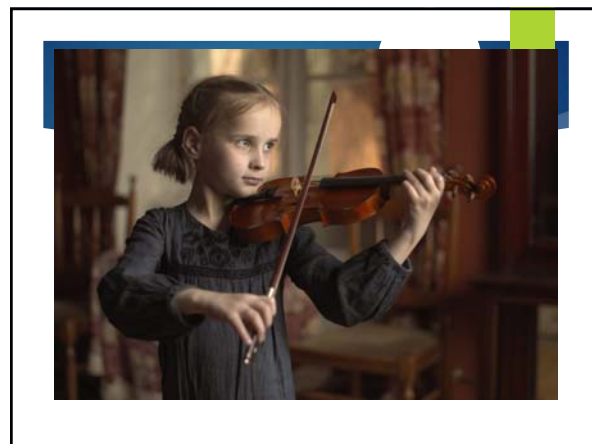
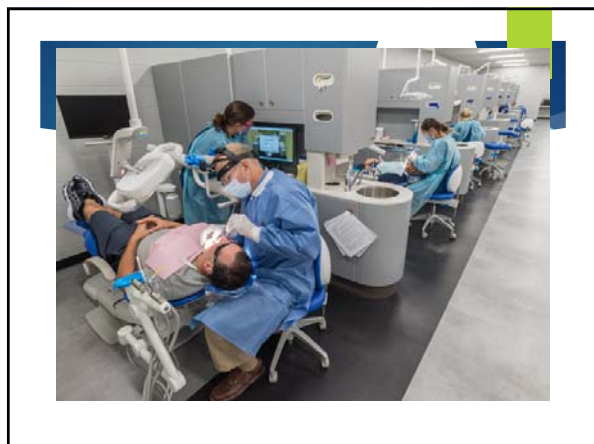
A chest X-ray image showing the lungs, heart, and spine. The image is oriented vertically. Text on the right side of the image reads: '2007 Acq Tm: 8 STA'.

Copyright © 2021 Postural Restoration Institute®. Used with permission. Postural Restoration Course [www.posturalrestoration.com](http://www.posturalrestoration.com)

### Inherent Right-sided Preference

- **Survival:**
  - reflexive response to avoid on-coming danger
  - baby makes way through birth canal by pushing off one foot to create rotation (Wallden, 2017)
- Teeter-totter effect, providing impetus to overcome inertia

### However.....



...further directing us into asymmetrical respiration

breathing in      breathing out

chest expands      chest contracts

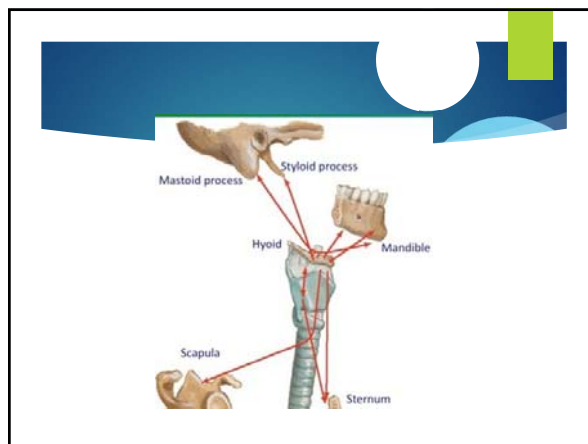
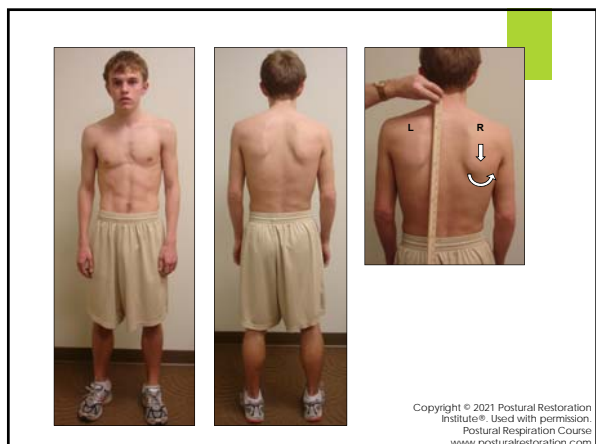
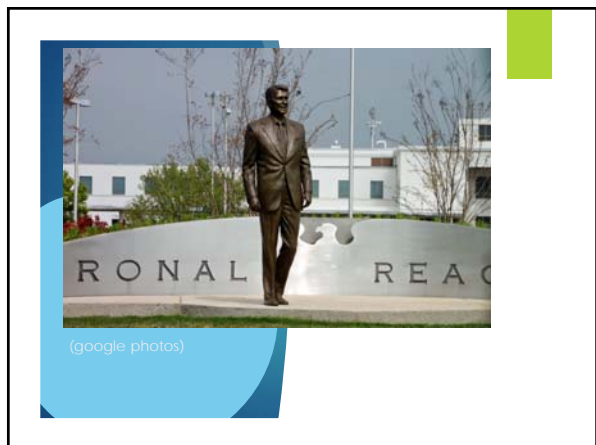
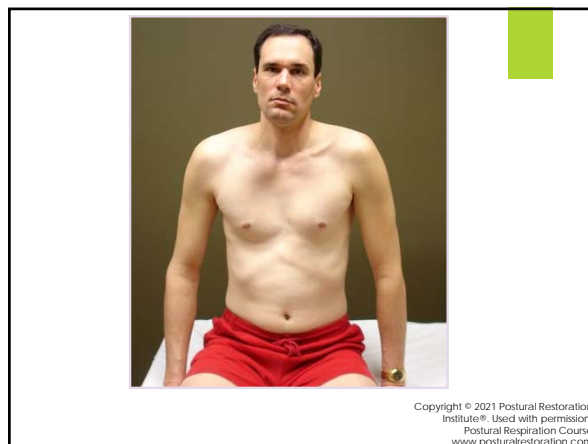
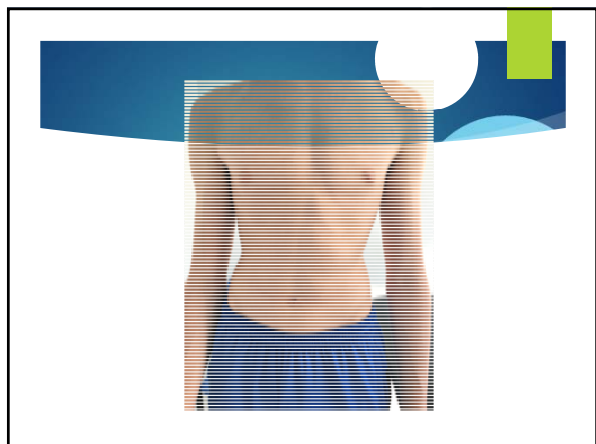
rib      lung

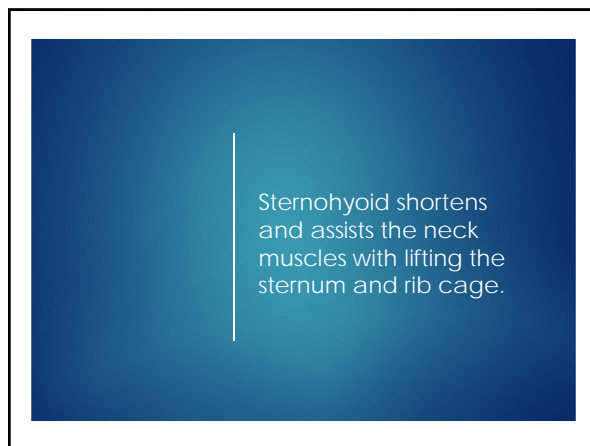
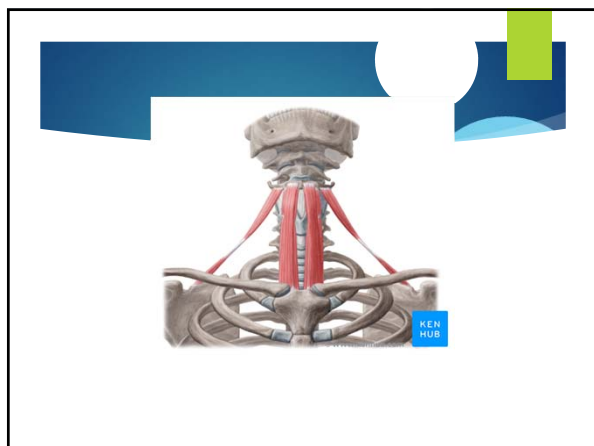
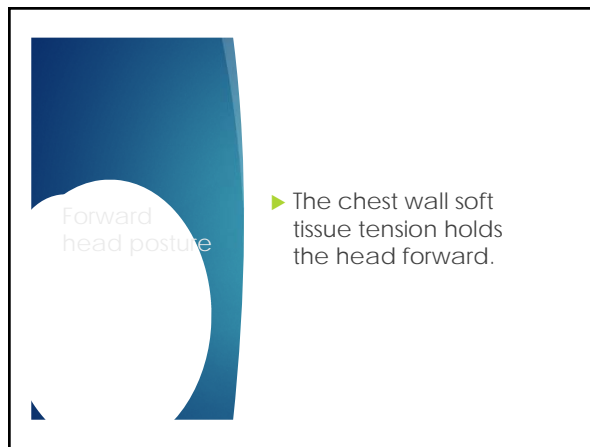
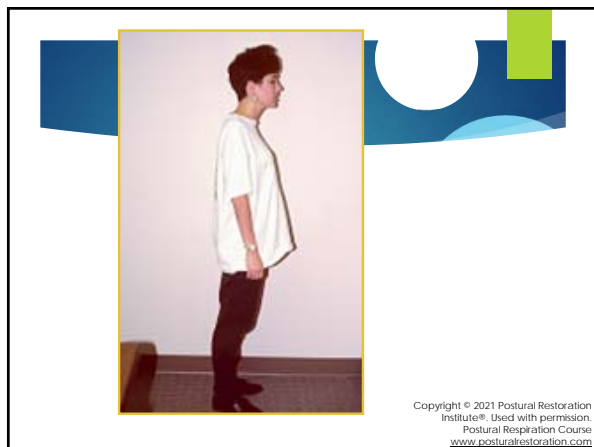
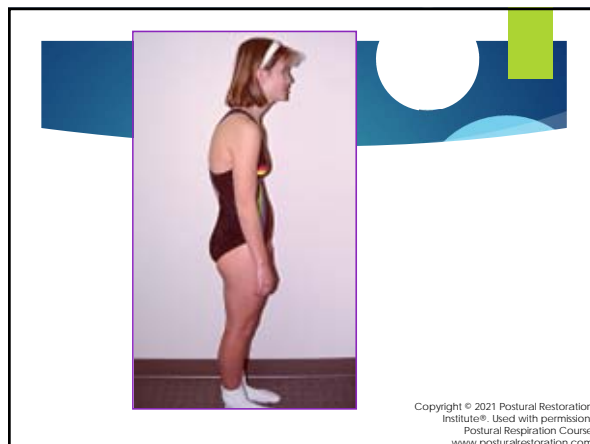
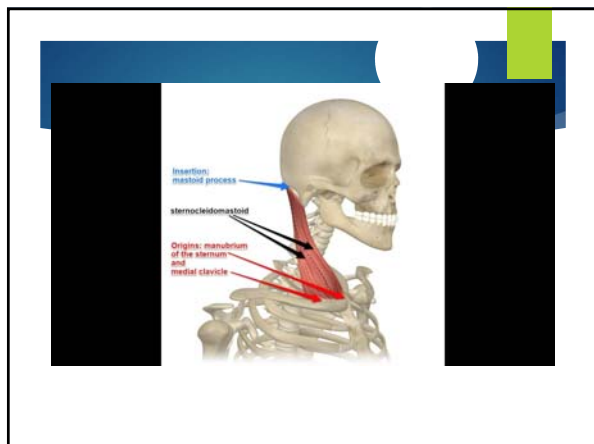
diaphragm contracts      diaphragm relaxes

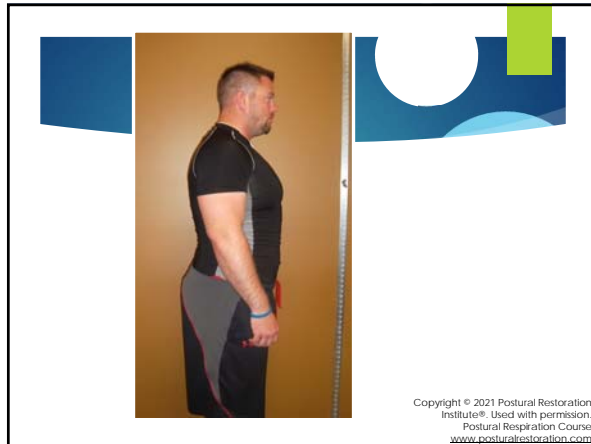
© 2006 Encyclopædia Britannica, Inc.

Insufficient Zone of Apposition, especially on left side of diaphragm:

- tipping forward of the left pelvis
- reduced weight-shift to left
- reduced grounding on left







The spine hyperextends and the sternum, rib cage, and scapula elevate.

Posterior chest wall tightens and cannot expand.

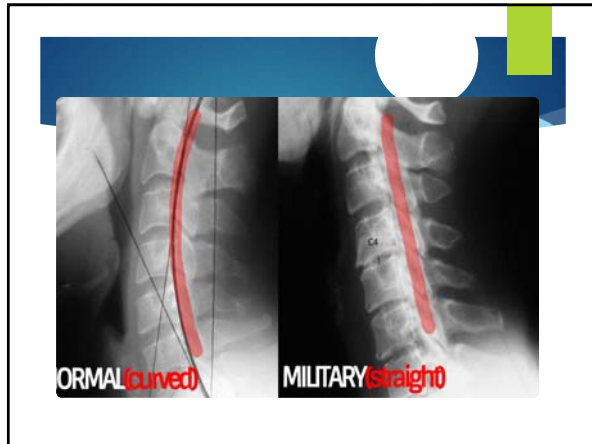
The individual will need to bring their heads forward *even more*.

### Forward head posture

Loss of cervical lordosis:

- ▶ Mid-neck moves back while mid-back moves forward.
- ▶ Neck no longer lengthens on stance leg or shortens on swing leg.





### Forward head posture

- ▶ Mandible drops down and back.
- ▶ Hyoid and mandible approximate.
- ▶ Anterior temporalis and masseter increase activity to pull the mandible up and away from the hyoid so the person can swallow.

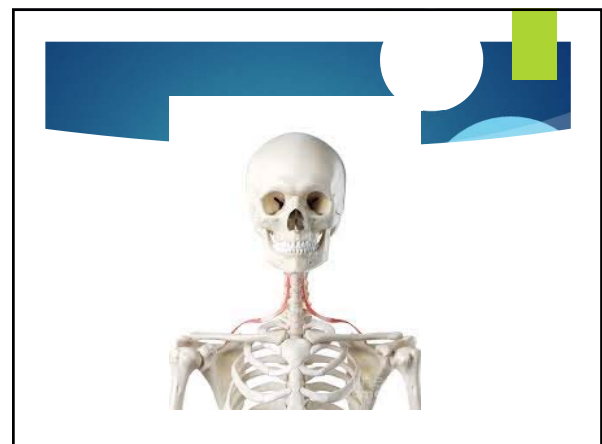
### Omohyoid

- ▶ "Omo" is Latin for shoulder blade.
- ▶ One of the infrahyoid muscles which, working together, depress the hyoid and assist with swallowing.



### Omohyoid

- Compresses the internal jugular vein. (Patra, et al: 1988)
- 2 bellies joined by a central tendon that is ensheathed by fibrous loop connecting to the clavicle and first rib and extending to the deep cervical fascia.
- Places tension on deep cervical fascia to reduce possibility of soft tissue being sucked inwardly during respiration. (Chaitow, Clinical Application of Neuromuscular Techniques of the Upper Body)



▶ To re-tension the right omohyoid:

- ▶ Heads are pulled forward.
- ▶ Mandibles move to the left.

Cranium, mandible, and hyoid are pulled *left*....

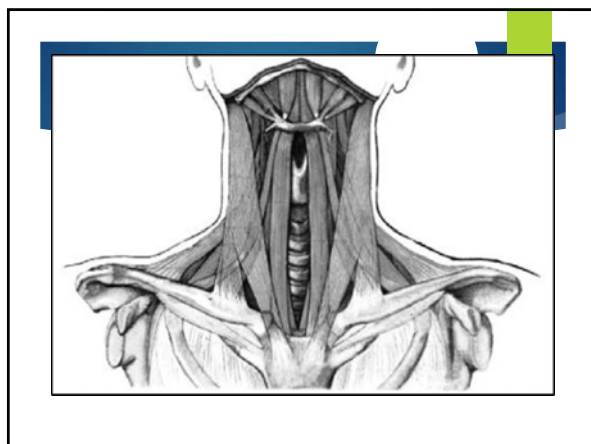
.... on a neck and chest that are oriented *right*.



Fullness & bulge of right side, flared left ear, high mouth angle on left

© 2015 Postural Restoration Institute®

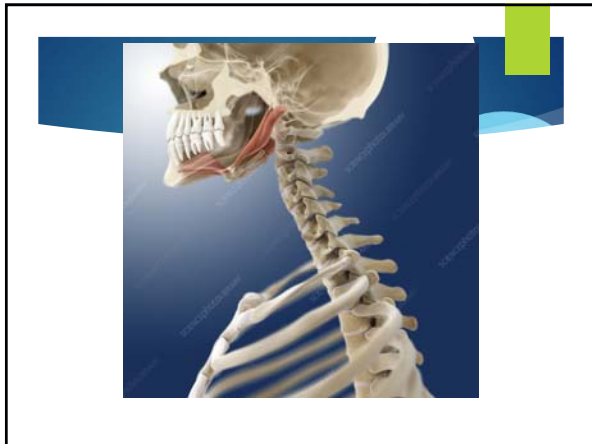
▶ The vestibular, ocular, occlusal systems adapt to this posture with its corresponding maladaptive airflow.



Suprahyoids: digastric, stylohyoid, mylohyoid, geniohyoid

- ▶ Elevate the hyoid.
- ▶ Widen the esophagus when swallowing.
- ▶ Provide position and shape of the larynx, playing a role in voice quality.

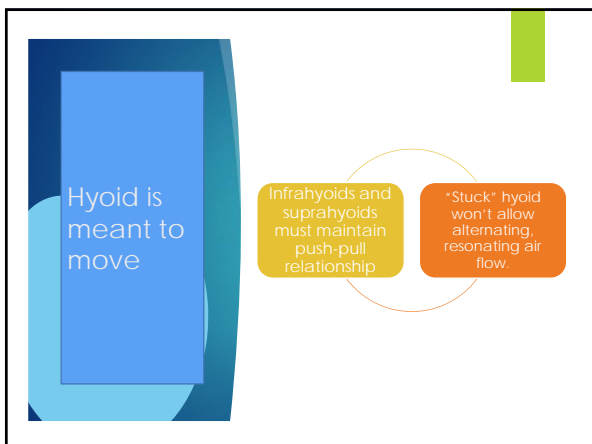




Hyperactivity of stylohyoid, styloglossus, and SCM moves cranium into a high level of extension on the atlas to assist in airway enlargement and to keep eyes level with horizon.

Suprahyoids may attempt to move the cranium back via the mandible.

Suprahyoids may become postural stabilizers – lose elastic, vibrant properties.



*Soft tissue tension balancing issue.* The individual is breathing with too much tension...

... because the left diaphragm cannot pull air in.

### Sense and Tense

We lose our sense of the ground when we tense our necks.

We tense our necks when we lose sense of the ground.


► These individuals tense their throat to walk.

### GOALS

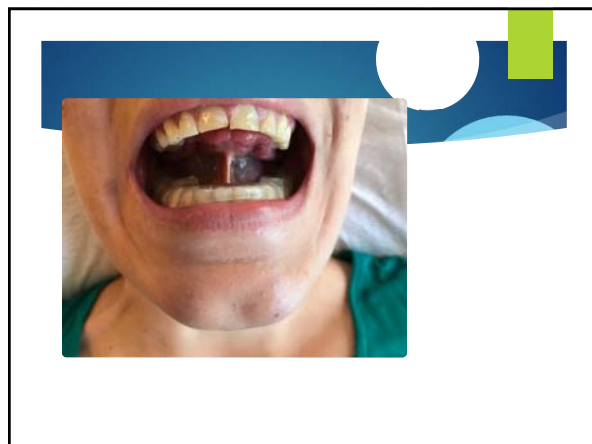
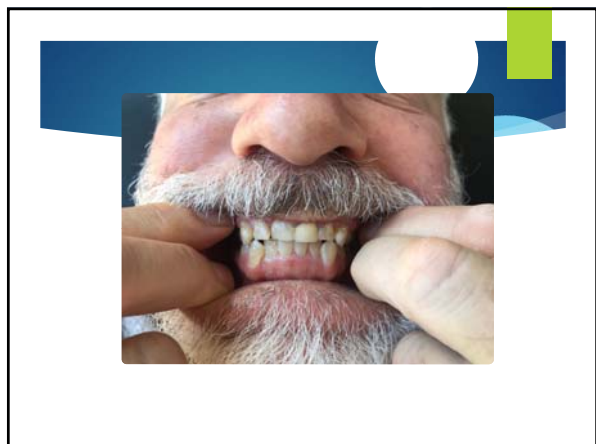
► Through arm reach – *arm swing* – activities...

- sense the left ground, abdominals
- establish left diaphragm
- fill the right thorax with air
- allow right arm to regain pendular movement

- free up the neck: 30 degrees of cervical lordosis, lateral flexion, and rotation
- restore cranium and jaw position
- allow tension and re-tension of infra- and suprahyoids
- HYOID OSCILLATION



COLLABORATION



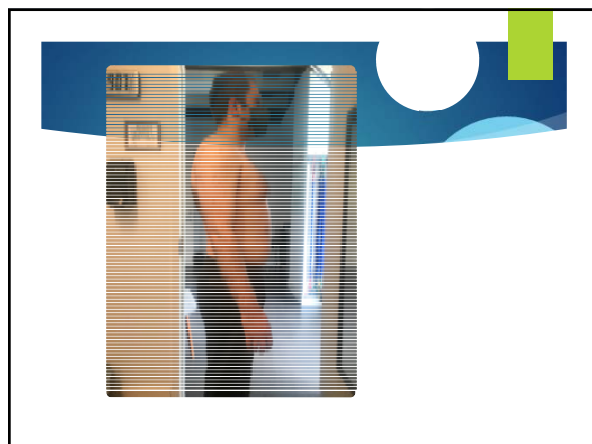
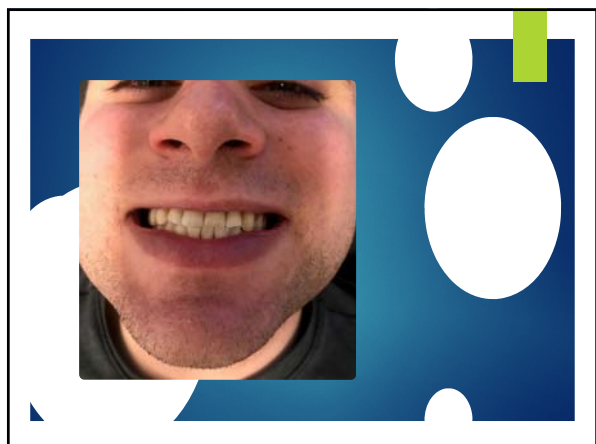
Patient JD:

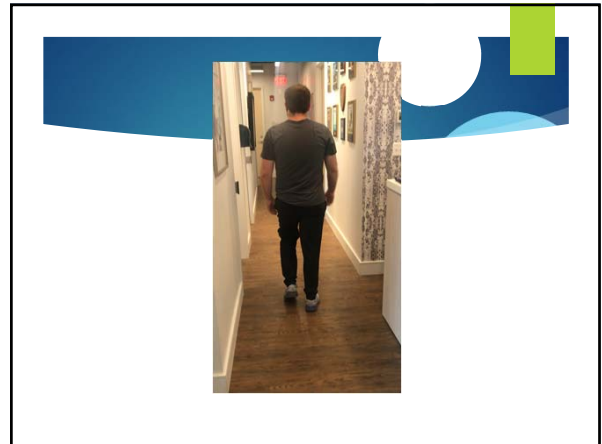
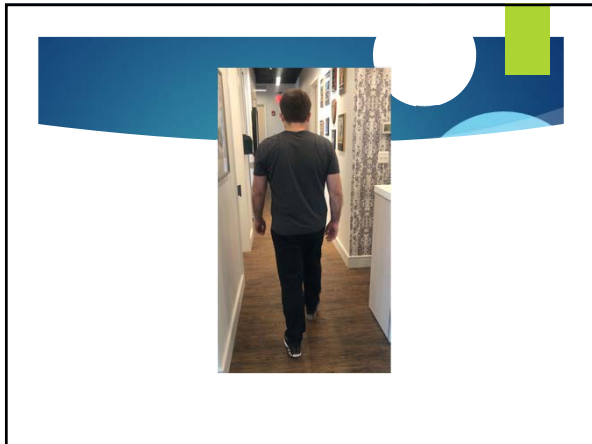
- c/o B foot pain; left low back pain p deadlifting
- previous competitive water polo player
- Injury to C1-2 as a teenager. "I felt light-headed. I wore a hard collar."

Denies snoring

States he breathes through his nose...

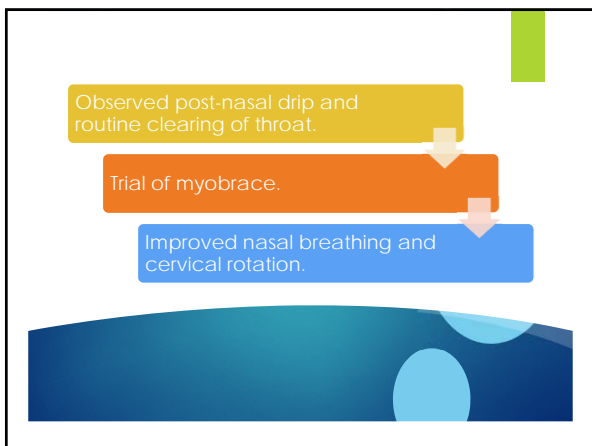
...yet back sleeper





► Referral to:  
Dr. Lupita Roca,  
DDS

► Dr. Roca determined that onset of low back pain coincided with breakage of retainer wire. In addition...



 An exercise instruction card. At the top, it says "Standing Supported Left AF IR with Right Arm Rock". Below the title is a photograph of a person in a red shirt and black shorts performing the exercise. Underneath the photo is a numbered list of 8 steps:
 

1. Head against a ball or cushion, and place your left foot on a 1 inch block. Place your right hand slightly ahead of your left knee.
2. Place your left hand on the floor in front of your feet and place your right hand slightly behind your left knee. You should feel a stretch in your left lower leg (calf). The majority of your weight should be on your left leg. Breathe and hold for 30 seconds.
3. Maintaining a neutral spine (not too far back or too far forward), pull your left knee to the right and rock your right arm on your shoulder to the left. You should feel your left lower back/midrange.
4. Rotate through your spine and attempt to lift your right arm wall with an open hand.
5. Rotate through your spine to your right foot and across your midline with your right arm.
6. Continue the process for 4 to 5 deep breaths, as through your nose and out through your mouth, switching to the other side with each exhalation.
7. Breathe and repeat 4 more times.

 At the bottom, it says "Reference: University of Utah Health, Utah Health, Salt Lake City, Utah. Copyright © 2011 Postural Restoration Institute."

Copyright © 2021 Postural Restoration Institute®. Used with permission. [www.posturalrestoration.com](http://www.posturalrestoration.com)

