The Role of Physical Therapy in the Management of the Obstructed and Unaligned Airway

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AAPMD Collaboration Cures
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Introduction

The dependence on what part of the body we have or had an interest in, who were our mentors, where we have relied on our scientific models of assessment, and when did the best outcomes of intervention work for us, determines our present different or dissimilar approach from others, in managing airway flow and regulating airway opening.

Regardless of the approach, the disciplines that are collaborating in the treatment approach and the direction or timing of events that are chosen in the treatment and management of the human airways, adequately monitor and address, when needed, homeostasis of the respiratory system, postural mechanics and autonomic symptoms.

The most natural way to normalize and maximize physiologic and psychologic respiratory performance, is to keep the cranial, mandibular, hyoid, and larynx balanced through hemi-cervical and hemi-diaphragmatic function. The human airways are dependent on both the orientation of the neck and the accompanying functional patterns of the mid-cervical spine, esophagus, and trachea.

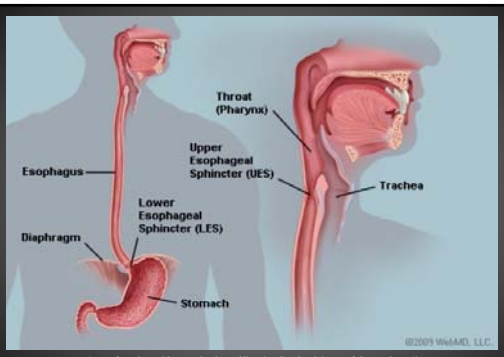


Image from: https://www.webmd.com/digestive-disorders/picture-of-the-esophagus#1

The way we swallow, speak, and suspire are ALL related directly to each other anatomically, neurologically, and phasically. How we move air up and out to speak, air down to exchange, and food down through sphincters, is all interrelated through patterned position and accompanying pressure that regulates autonomic physiologic outcomes.

Independent interdisciplinary research will suggest that airway lumens depend on:

1) symmetrical mandibular lateral trusive function, not mandibular cants;
2) hyoid elevation, not depression;
3) laryngeal drop, not lift;
4) anterior and middle tongue strength, not restriction;

5) velopharyngeal seal, not just nasal or choanae passage imbalance;
6) cervical axial rotation, not cervical segmental rotation;
7) mid-cervical lateral flexion, not cranial cervical lateral flexion;
8) pendular arm swing, not just torso rotation from imbalanced abdominal function;

9) diaphragmatic expansion of each lung, not focus on suppression of anterior neck accessories; and
10) intercostal flexibility, not appendicular flexibility

Power, endurance, energy expenditure, volume displacement and performance are all entirely related to what amount goes in and out of the human lung and gut, and how it gets there. Restricting or limiting content flow, within the lumen of the pharyngeal, trachea and esophageal walls, impacts not only our physical performance, but has a significant impact on our anxiety (physiologic) and emotions (psychologic).

Furthermore, sex differences in pulmonary anatomy have recently been extended to the geometry of the thorax and ribs.

(Garcia-Martinez D. et al, Morphological and functional implications of sexual dimorphism in the human skeletal thorax. Am J Phys Anthropol. 2016 Jan;161:467-477.)

Airway luminal area is the major determinant of resistance to airflow in the tracheobronchial tree, and has a significant impact on power and endurance. When that tree becomes lopsided because of stance, occupational, and physiologic patterning, our pattern and placement of our airway resembles what many healthy women who have dysanapsis, are experiencing.

When airflow obstruction, in the healthy individual, is reflected by the inability to forcefully blow out roughly 80% of their vital capacity in one second, the ability to breathe in, is as equally difficult, if not more.

(Thompson BR. Dysanapsis – once believed to be a physiological curiosity – is now clinically important. Am J of Respir and Critical Care Med. Feb 2017;195(3):277-278.)

Women who have smaller airways and tracheal lumens than men with similar lung size, are especially susceptible to pulmonary constraints during exercise.

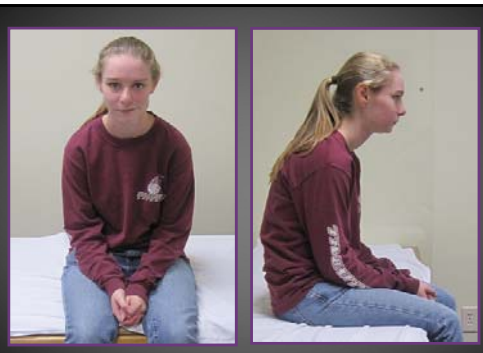
(Dominelli PB, et al. Sex differences in large conducting airway anatomy. J Appl Physiol. 2018;125:960-965.)

It also stands to reason why some men, with longer airways and wider lumens, have more difficulty regulating both vertical and horizontal positioning for respiratory function and flow.

Of course, there are many studies that indicate the number one flow limitation and dysanapsis in children and adolescents with exertional dyspnea is obesity, something all physical therapists should recognize and counsel families on.

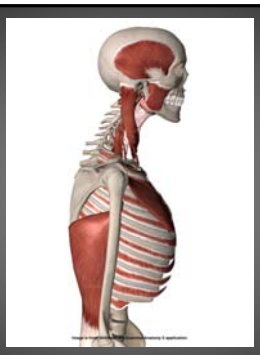
(Forno E, et al. Obesity and airway dysanapsis in children with and without asthma. Am J Respir Crit Care Med. 2017 Feb 1;195(3):314-323.)

When any of the above conditions are limited because of dependency on accompanying or associated asymmetrical function and form, the airway openings and lumens, proximally, distally or uniformly, will be compromised; resulting in the need to advance the head and upper neck forward.



Torsional obstruction at either the upper airways or at the lower airways, secondary to the need to advance the head and upper neck forward and to one side, influence the respiratory CNS and ANS compensatory demands on the accessory respiratory muscle of the lower back and upper neck, which also extend the back and neck.

Latissimus, quadratus lumborum, psoas, sternocleidomastoid, posterior rectus capitis and levator scapulae compromise airflow management, because of their direct impact on limiting upper cervical flexion, lumbar flexion and tracheal/esophageal flow.



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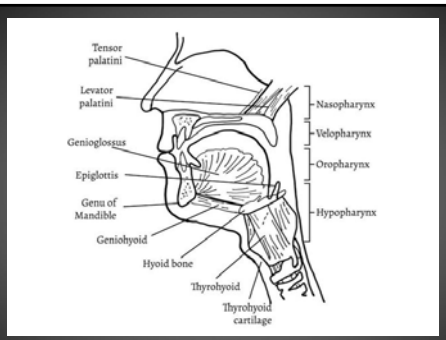


Figure from: Mete A, Akbudak IH. Functional anatomy and physiology of airway. Available open access on https://www.intechopen.com/books/tracheal-intubation/functional-anatomy-and-physiology-of-airway

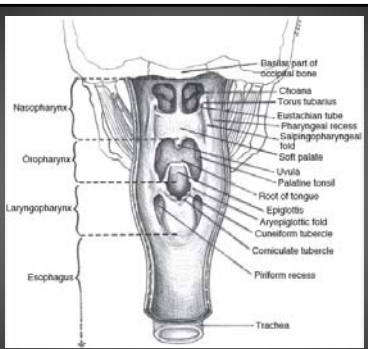


Fig. 5.1 Opened posterior view of the pharynx, demonstrating the boundaries of the nasopharynx, oropharynx, and hypopharynx. (From: Van de Water TR, Staecker H. Otolaryngology: Basic Science and Clinical Review. New York: Thieme; 2006:553. Permission Pending.)

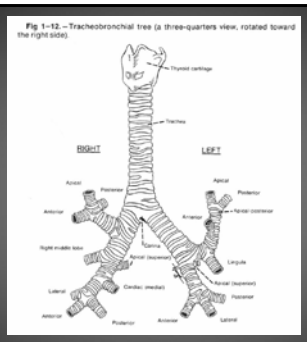


Figure from: Frownfelter DL. Chest physical therapy and pulmonary rehabilitation: An interdisciplinary approach (1978). Year Book Medical Publishers, Inc. Chicago.

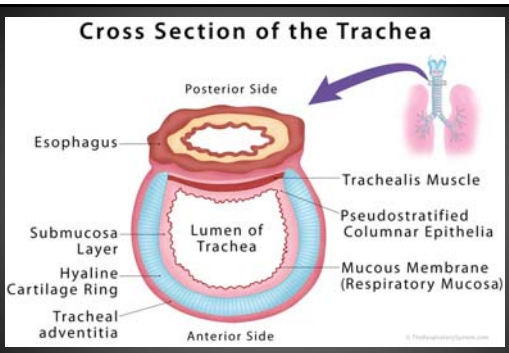
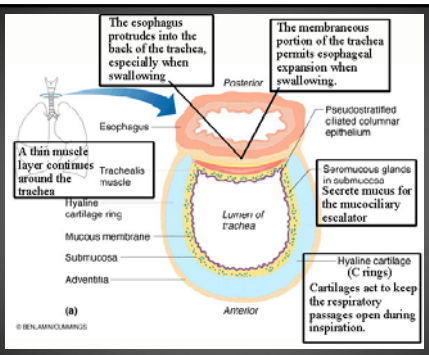


Image from: https://www.therespiratorysystem.com/trachea/



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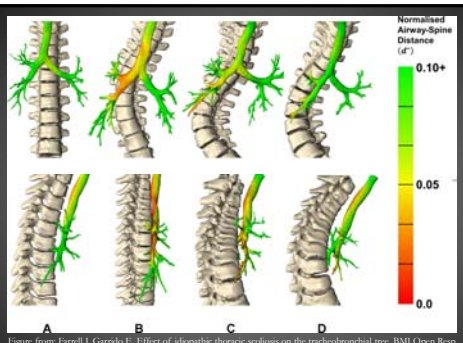


Figure from: Farrell J, Garrido E. Effect of idiopathic thoracic scoliosis on the tracheobronchial tree. BMJ Open Resp Res2018;5:e000264. doi:10.1136/bmjresp-2017-000264. Available with open access online at https://bmjopenrespres.bmj.com/content/bmjresp/5/1/e000264.full.pdf

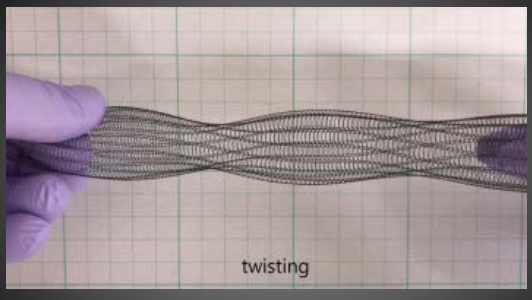


Figure from: Sakaguchi Y, et al. Development of a novel tissue-engineered nitinol frame artificial trachea with native-like physical characteristics. The Journal of Thoracic and Cardiovascular Surgery. Sept 2018:1264-1272. Available online with open access at https://www.sciencedirect.com/science/article/pii/S002252231831211X#dfig1

In order to optimize bolus flow through the esophagus and airflow through the trachea and bronchial respiratory tree, postural alignment of the head with respect to the neck and chest is necessary for speed and safety associated with unobstructed swallowing and breathing.

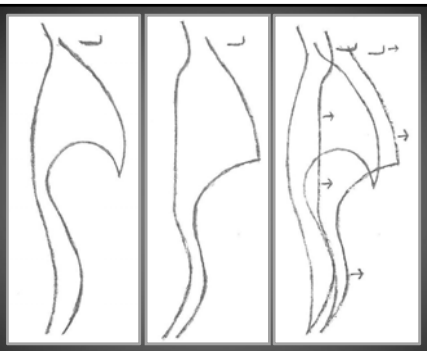
Malalignment of head and neck positions have an immediate and negative impact on respiratory function, something anesthesiologists and oncologists know a lot about. Slumped, kyphotic posture, and reversal of thoracic and cervical normal curvature increases intra-abdominal pressure making movement of the diaphragm difficult, leading to reduced lung capacity and inspiratory flow.

Approximation of ribs and pelvis in subjects with slumped and kyphotic posture has been shown to increase intra-abdominal pressure, making movement of the diaphragm difficult, leading to reduced lung capacity and inspiratory flow.

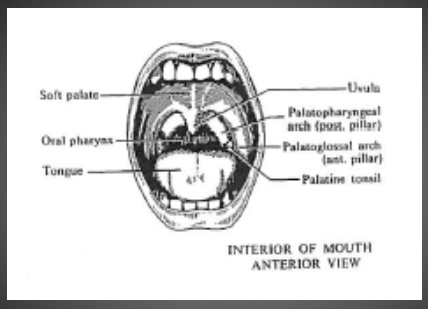
(Lin F. et al. Effect of different sitting postures on lung capacity, expiratory flow, and lumbar lordosis. Archives of Physical Medicine and Rehabilitation, 2006;87(4).)

Similarly, in patients with 'forward head posture' and torticollis, "flattening of normal cervical curve and development of secondary round upper back, compress the chest cavity which can alter breathing capacity".

(Gore DR, et al. Roentgenographic findings of the cervical spine in asymptomatic people. The Spine Journal, 1986;11(6).)



The fibers of several facial muscles align in a serial fashion to create muscular slings around the oropharynx and laryngopharynx.



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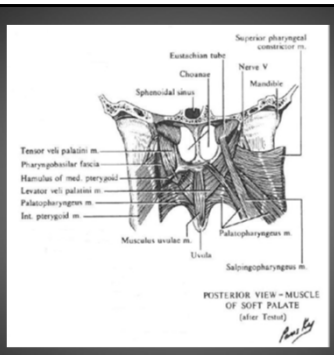

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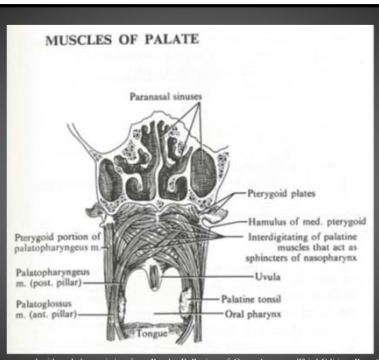

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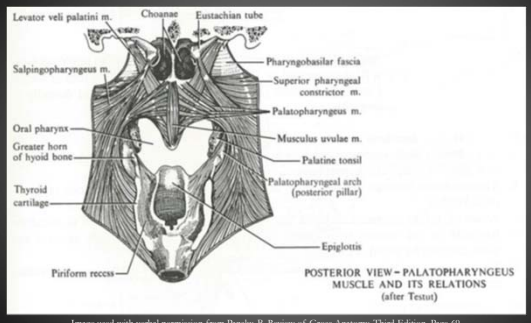

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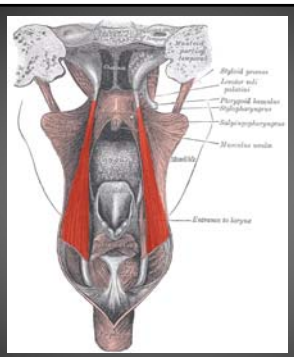
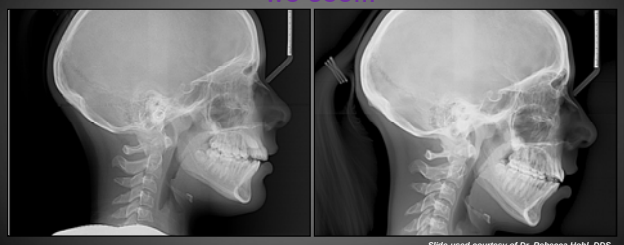


Image from: https://en.wikipedia.org/wiki/Salpingopharyngeus_muscle

These slings must be able to actively move through unrestricted cervical function in order to create and maintain adequate tubular positive pressure and propulsion of food boli and airflow. Pendular arm swing and mandibular freedom assists with this propulsion, or gentle push, of food downward (peristalsis) and air going up (expulsion/exhalation).

Human head forward movement assists with opening up and expanding the nasopharynx. However, velopharyngeal control from the velum or soft palate is sacrificed as the lateral pharyngeal walls, and the posterior wall of the pharynx and the anterior wall of the arch of the atlas oppose each other.

Over a period of time Postural Change can occur to accommodate breathing patterns and we see...



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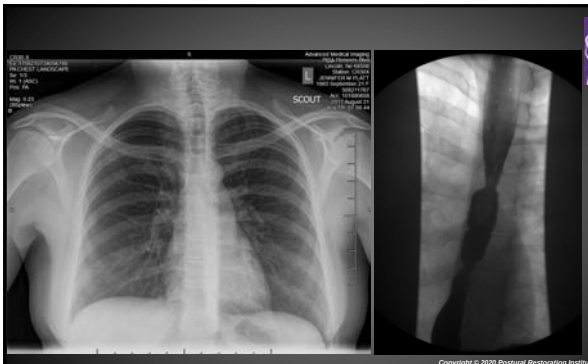
The lumen and muscular anatomy, directly anterior to the resting cervical and upper thoracic spine, therefore, no longer uniformly align with normal resting upright cervical or neck midline; simply because the neck is positioned off to one side as the head and upper neck advance forward.



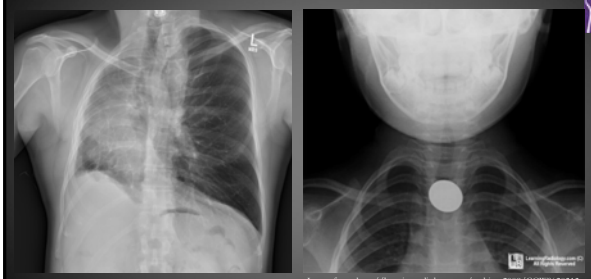
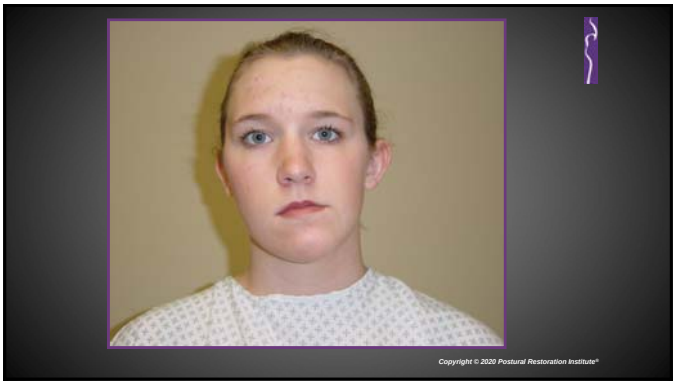


Image from: http://learningradiology.com/archives2008/COW%20313-Cont%20hn%20esophagus/contesophcorrect.htm.



The malalignment or malposition of the midline of the trachea, and the soft tissue attached to it, on it and around it, contribute to their muscular sling incapability of support and stability for normal unrestricted breathing or swallowing. When a head and neck move forward, lateralized orientation and compensation usually follow, further contributing to torsional soft tissue constraint.

<u>Patterned</u> cervical rotational, torsional, and forward mal-positional function leads to:

- Open mouth posture
- Decreased lip closure
- Occlusal malalignment, posterior crossbite, and anterior or lateral open bites
- Pocketing of food
- Poor anterior to posterior propulsion in the oral cavity (related to decreased positive pressure)
- Drooling

- Temporomandibular dysfunction
- Misalignment of paired bones of the cranium
- Palatal and mandibular arch asymmetry and deviation
- Retrognathia
- Class II skeletal type, dolichofacial presentation
- Posterior rotational mandibular growth
- Limited first rib-manubrium movement and apical expansion upon inhalation*

<u>Placed</u> airway rotational, torsional, and mal-positional functional leads to:

- Nasopharyngeal and intra-pharyngeal airflow obstruction
- An increase in laryngopharynx airway resistance*
- Arytenoid cartilage and muscular dissonance

(* are the two most important considerations a physical therapist or movement specialist should consider when designing specific individualized goals for the airway challenged patient.)

Cone-beam computed tomography (CBCT) studies have shown there is a relationship between head position and pharyngeal airway distances and cross-sectional area. Head placement and position reflects compensatory physiological postural mechanics that serve to maintain airway adequacy, especially in the obstructive sleep apnea (OSA) patient.

This forward head placement associated pharyngeal airway cross-sectional distance may be due to a stretch of the pharyngeal airway at the hyoid level.

(Sonnesen L, et al. Pharyngeal airway dimensions and head posture in obstructive sleep apnea patients with and without morphological deviations in the upper cervical spine. J of Oral and Maxillofacial Research, 2017;8(3).)

Pharyngeal airway patency depends on the relative influence of pharyngeal airway dimensions, pharyngeal airway compliance and the negative intraluminal pressure during inspiration.

(Hudgel DW. Mechanisms of obstructive sleep apnea. Chest. 1992 Feb; 101(2).)

The stretch of the pharyngeal airway (narrowing) with an extended and forward head posture may decrease the risk of airway collapsibility due to changes in pharyngeal airway dimensions and interluminal pressure during inspiration locally at the hyoid level.

(Sonnesen L et al.)
(Solow B, et al. Airway dimensions and head posture in obstructive sleep apnea. Eur J Orthod. 1996 Dec, 18(6).)

The soft palate also has an important role in determining the placement of the airway and the route of respiration.

(Matsuo K, et al. Coordination of mastication, swallowing and breathing. Jpn Dent Sci Rev. 2009 May;45(1):31-40.)

During nasal breathing, the soft palate is lowered and apposed to the tongue, dilating the velopharyngeal isthmus or retro-palatal airway patency. During oral breathing, in contrast, the soft palate elevates to open the fauces, separating the nasal cavity from the pharyngeal airway.

(Matsuo K, et al.)

The two main muscles for determining palatal position are the levator veli palatini and the palatoglossus. Both muscles are active during oral (levator palatini) and nasal (palatoglossus) breathing.

(Tangel DJ, et al. Respiratory-related control of palatoglossus and levator palatini muscle activity. J Appl Physio. 1995 Feb; 78(2):680-8.)

Both of these muscles are placed in paradoxical positions and their effectiveness is reduced when the hard palate is moved up and forward with respect to the oropharynx.

On the other side of the anterior nasopharyngeal wall are the nasal passages (vestibules and choanae) that can impair nasal flow and nasal breathing. Impaired nasal breathing causes changes in head posture, by enlarging craniocervical angulation and the nasal cross-sectional area of the nasal passages, through forward inclination of the cervical spine, for better airflow.

However, this also compromises the cross section of the laryngopharynx passage. One may now breathe better through the nose, but the overall flow through the lower pharynx compromises this achievement.

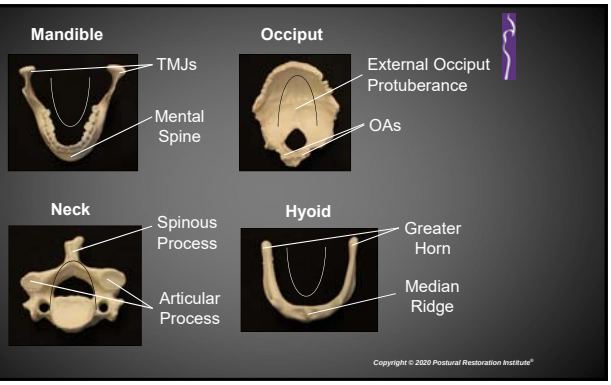
(Huggare, J A, et al. Nasorespiratory function and head posture. Am J Orthod Dentofacial Orthop. 1997 Nov; 112(5): 507-11.)

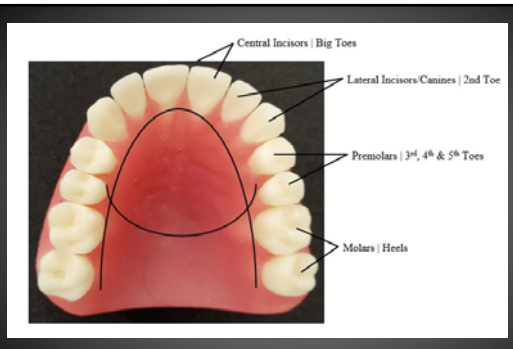
Collapse, Compression, Crowding, Convergence, and Constriction Corollaries

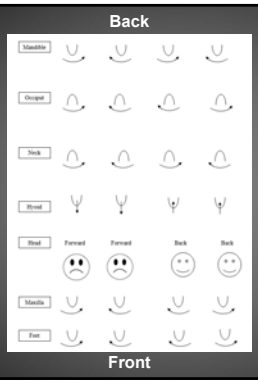
The human foot, rib, maxilla, hyoid, and mandible have the greatest impact on cervical alignment and accompanying airway aperture. These bones are (or are part of) an anatomical arch that directs and guides expansion, decompression, spacing and divergence in and around cavities and conduits that permit unobstructed flow of fluid and air.

ARCHES were designed to rock, rotate and resonate, the body for balanced drainage, flow and exchange.

They are structures that are bow-like or have a curved outline, that when moved directionally from one side to the other and back, lifts on one side as the other lowers, compresses on one side as the other decompresses, and un-balances at the end of one direction only to rebalance as it passes midline and moves to the other direction.







Many of the patients we work with who have difficulty with positional management of airflow because of patterned cervical torsional issues, also have contributing factors that hold up the progress and success of multi-disciplinary intervention. The greatest challenge health care professionals, in general, contend with is arch management that prevents flow usually throughout one side of the body, more than the other.

When ARCHES OF THE FEET become flattened or too rigid (high), heads advance forward passively, or actively respectively.

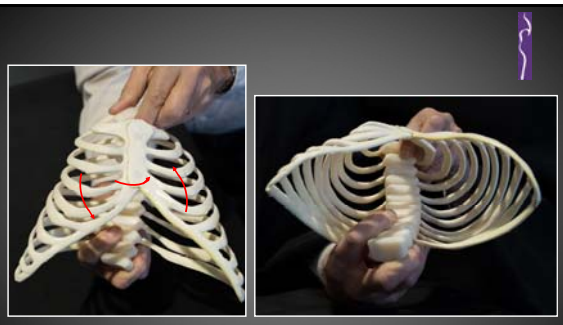
Marchena-Rodriquez, et al, observed the high incidence of Class II malocclusion in children with supinated feet, and the higher incidence of Class III in children with pronated feet.

(Marchena-Rodriquez A, et al. Relationship between foot posture and dental malocclusions in children aged 6 to 9 years. Medicine (Baltimore) 2018 May; 97(19): e0701.)

Rothbart, concluded that the relative loss of vertical facial dimension is related to both pronated feet and the side the foot is more pronated on.

(Rothbart B. Vertical facial dimensions linked to abnormal foot motion. J Am Podiatr Med Assoc, 2008;98(3).)

When ARCHES OF THE RIBS become over widened, upper necks and heads are "pulled" forward and down.



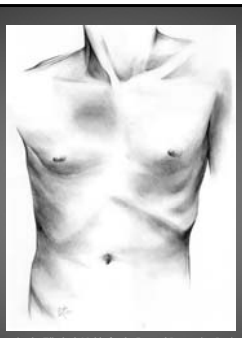


Illustration by Elizabeth Noble for the Postural Restoration Institute®

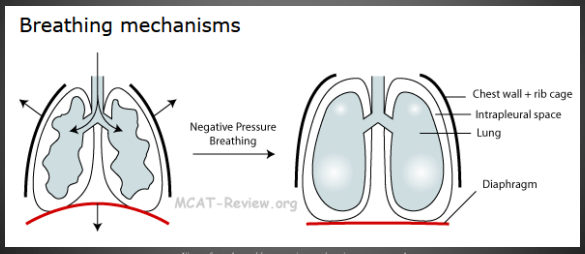


Figure from: https://mcat-review.org/respiratory-system.php

When ARCHES OF THE MAXILLA become high on one side or both sides, the cranium or head is restricted in osseous expansive movement during inhalation, therefore requiring the cranium to anteriorly rotate on the occiput.

The occiput and head simultaneously have to move forward, for expansion to occur during inhalation with a cranium that is "stuck" in cranial extension. Vertical expansion of the cranium, through osseous sagittal sutural function, compliments an airway that it kept open by this paradoxical cranial function.

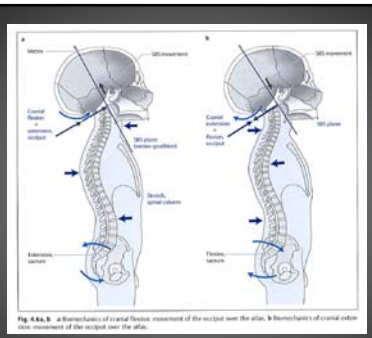
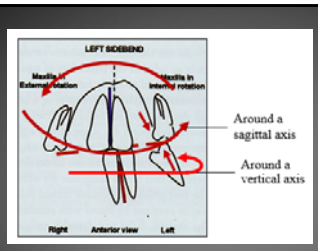


Image from Richter P, Hebgen E. Trigger Points and Muscle Chains in Osteopathy. 2009. Permission Pending.



Arrows added to the image for this presentation.
Occiput and temporals are oriented to the Left and the mandible rotates latero-trusively to the left. (From the anterior view)

Image from: James G, Strukus D. Cranial strains and malocclusion; International Journal of Orthodontics; Vol 17 (1-3) 2006. Used with permission of the IJO.

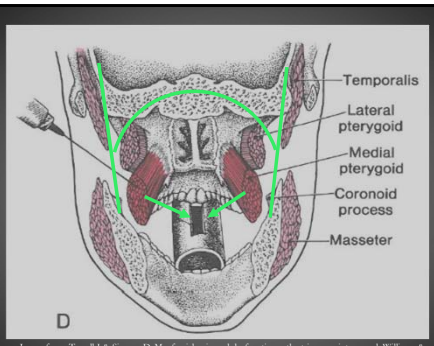


Image from: Travell J & Simons D. Myofascial pain and dysfunction – the trigger point manual. Williams & Wilkins 1983.

Mouth Breathers are commonly seen with Constricted Maxillary Arches

- Causes downward and forward positioning of tongue to facilitate breathing
- Open bites in the anterior
- Super erupted posterior teeth
- Mandible rotated down and back
- Increased overjet
- Extension of head and neck
- Inferiorly positioned hyoid bone

Slide used courtesy of Dr. Rebecca Hohl, DDS
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It is worth noting, that there is a significant statistical increase in nasopharyngeal airway size, cervical curvature angle, and flexion of the cranium or head, together with a significant decrease in craniocervical angulation. Studies also strongly suggest that improvement of respiratory function, result in a change in head position (desirable airway position).

(Simona T, et al. Evaluation of cervical posture following palatal expansion: a 12 – month follow-up controlled study. Euro J Orthodont, 2007.)

When the ARCH OF THE HYOID becomes unaligned at rest with the mandible, and becomes tipped down and back, airway impedance increases.

Of the two hyoid slings, the suprahyoid sling is the most vibrant, eccentric, active and elastic.

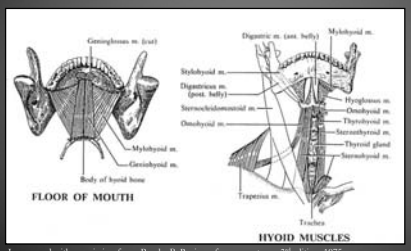


Image used with permission from: Pansky B. Review of gross anatomy, 3rd edition. 1975. MacMillan Publishing Co, Inc. New York, New York.

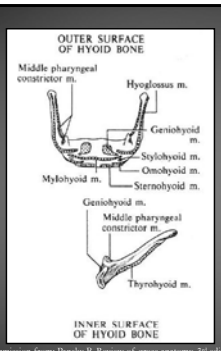


Image used with permission from: Pansky B. Review of gross anatomy, 3rd edition. 1975. MacMillan Publishing Co, Inc. New York, New York.

The four muscles of the suprahyoid sling are the digastric, stylohyoid, geniohyoid, and mylohyoid. They are considered <u>pharyngeal</u> muscles with the exception of the geniohyoid muscle.

They all:

- assist in elevating the hyoid
- <u>widen</u> the esophagus during swallowing

However, for them to effectively work, they require counter or antagonistic balance from the infrahyoid muscle.

The infrahyoid sling muscle positions the hyoid bone from the thorax. They play an active role in swallowing and larynx movement, as well as with depression of the hyoid.

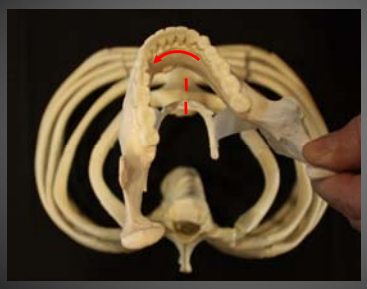
Maintaining symmetry of the hyoid and balance of the anterior neck, reduces tension of the suprahyoid muscle and dropping (down and back) of the hyoid.

(Gonzalez HE, Manus A. Forward head posture: Its structure and functional influence on the stomatognathic system, a conceptual study. Journal of Craniomandibular Practice. 1996, 14:71-80.)

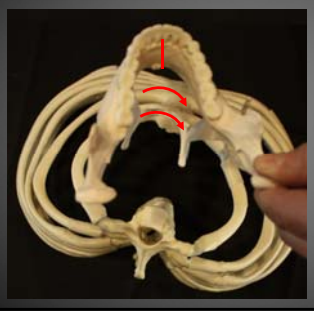
An insecure and imbalanced hyoid poorly elevates the larynx during swallowing, and epiglottis and pharynx regulation activity behind it.

Our hyoid, infrahyoid and suprahyoid position depends on our mandibular and thoracic independent unrestricted movement. Restriction of the mandible or upper chest results in hyoid backward, downward and lateral displacement with respect to the forward depressed head and anterior elevated chest.

Mandibular sling to the left



Hyoid and Clavicle/1st rib sling to the right



The most influential muscle of hyoid angulation and position is the omohyoid, since it is the muscle responsible for hyoid depression and pharyngeal collapse.

When the scapula (usually right) is positioned in an upwardly rotated, internally rotated, and anteriorly protracted/posteriorly retracted state, the accompanying hyoid retraction and depression influences airflow, circulation to the brain and our baroreceptors.

Alternating movement of the mandible, with simultaneous contralateral movement of the occiput, and ipsilateral movement of the atlas and neck will balance the tri-planar tension of the hyoid suspensory and inspiratory (omohyoid and sternohyoid) musculature and fascia, and thus contribute to unobstructed swallowing, voice production (vocal cord function) and breathing.

When the ARCH OF THE MANDIBLE is pulled down and backward, the tongue base elevates and contributes to the compromised upper airway physiology.

A low hyoid with a low tongue posture puts the geniohyoid at a mechanical disadvantage by creating a need for tongue elevation, which results in more downward and backward postural forces on the mandible. This, together with a larger tongue, may cause an increase in the mandibular load and thereby an interruption of the postural balances of the craniomandibular complex.

(Ozbek MM, et al. Natural head posture, upper airway morphology and obstructive sleep apnoea severity in adults. Euro J. Ortho, 1998;20(2):133-143.)

The relative larger and longer tongue, the lower hyoid bone position in relation to the mandibular plane, and the compromised upper airway physiology may be some of the factors triggering the adaptive changes so often seen in natural head position of the obese patient.

Another study showed that in cases of extended craniocervical posture, the equilibrium between lips, cheeks, and tongue on the lower incisors is altered. "In fact, extended head posture creates a stretch of the oral soft tissues resulting in increased lip pressure and in decreased pressure of the anterior part of the tongue on the lower incisors."

(Pachi F, et al. Head posture and lower arch dental crowding, Angle Orthodontist, 2009; 79(5):873-9.)

This "long term" condition could modify the inclination of the lower incisors toward a lingual direction.

(Pachi, et al.)

The best way to keep the mandible, hyoid and scapulae alternating is through air moving in, out and around us during hemi-chest intercostal reciprocal movement, provided by pendular inter and intra-limb forward locomotor movement.

LEFT
Heel Strike
Palm In
Early Hemi-Chest Compression
Peripheral Contact

RIGHT
Push Off
Pull Back
Late Hemi-Chest Compression
Late Peripheral Propulsion

The following three tests provide outcome measurements that reflect laryngopharynx airway alignment, before and after application of coordinated respiratory movement that reduces upper thoracic and lower cervical airway resistance pressure, and airway flow through the oropharynx and nasopharynx.

Shoulder Horizontal Abduction

Patient lies in supine with knees flexed to flatten the lumbar spine. Passively take the patient's arm into horizontal abduction while securing the shoulder joint and anterior rib cage with one hand and maintaining forearm supination with the other hand.

Shoulder Horizontal Abduction

Positive Test

Negative Test

- A positive test is indicated by limited shoulder horizontal abduction on one or both sides. Less than 45° is considered limited.

Cervical Lateral Flexion

Patient lies supine with knees flexed to flatten the lumbar spine. Dim the lights if needed for a patient who has high sensitivity to lights. Place both hands around the upper neck with your right index finger at the level of C4. Slightly move your left hand up the spine so that the patient's occiput lays in the lateral aspect of your palm. Using your right index finger as a fulcrum, passively move the upper segments of C2 to C7 and the head to the right as the left hand/index finger serves as a fulcrum. The average range of lateral flexion to one direction is 30° to 40°. Compare this motion to the motion in the other direction by reversing the above testing technique.

Cervical Lateral Flexion

Positive Test

Negative Test

- A positive test is indicated by limitation in one direction when compared to the other, or when inequality of range of motion exists at the C2-C7 joints.

Cervical Axial Rotation

Patient lies in supine with knees flexed to flatten the lumbar spine. Place both hands around each side of the patient's neck, with little fingers placed on distal transverse processes of C2, middle fingers placed on transverse processes of C7 and index fingers placed on spinous process of T1. Place thumbs directly under and parallel to SCM's. Passively rotate the cervical spine as a unit to the left by rotating the neck with right thumb, 3rd, 4th, and 5th fingers while right index finger stabilizes T1. Compare soft tissue limitations or rotational limits or differences secondary to thoracic spine position by rotating neck from neutral to the left and from neutral to the right.

Cervical Axial Rotation

Negative test (not limited) *Neutral* *Positive test (limited)*

- A positive test is indicated by limitation in one direction when compared to the other.

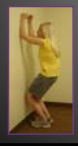
Apical Expansion Activities That Promote Airway Alignment Without Cervical Extension

The following activities/techniques promote aligned, unobstructed airflow at the nasopharynx and laryngopharynx, without active occipital or cervical extension.

Supine Hooklying Synchronized Resisted Glute Max

Prone Bilateral Apical Expansion with HG ER

Seated Supported Bilateral Posterior Mediastinum Expansion with Subscapularis Stretch



Standing Serratus Stomatognathic Squat

Postural Restoration Institute®

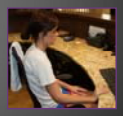
Supine Hooklying Synchronized Resisted Glute Max

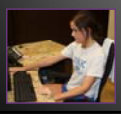
The following activities/techniques promote inhibition of cervical torsional and rotational influence on airway mal-position, without active occipital or cervical extension.

Supine Hooklying T8 Extension

Seated Left Posterior Mediastinum Expansion

Seated Supported Respiratory Left Posterior Mediastinum Expansion with Right Trap and Tricep





Seated Supported Respiratory Left Posterior Mediastinum Expansion

The following activities/techniques promote length and expansion of the hypolarynx to reduce the effort placed on muscles of the hypopharynx for pressure management and resonance of airflow, without active occipital or cervical extension.

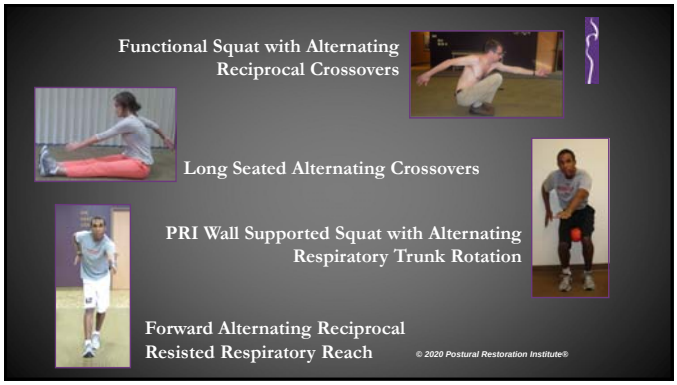
Single Leg Right Apical Overhead Reach

Sternal Positional Stretch

Stair Short Seated Balloon

Latissimus Hang with Balloon

The following activities/techniques promote alternation of hemi-chest and hemi-cranial airflow through cervical and tracheal midline transition, without active occipital or cervical extension.


Functional Squat with Alternating Reciprocal Crossovers
Long Seated Alternating Crossovers
PRI Wall Supported Squat with Alternating Respiratory Trunk Rotation
Forward Alternating Reciprocal Resisted Respiratory Reach
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Thank you!
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Hruska.Ron@posturalrestoration.com
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Supine Hooklying Synchronized Resisted Glute Max

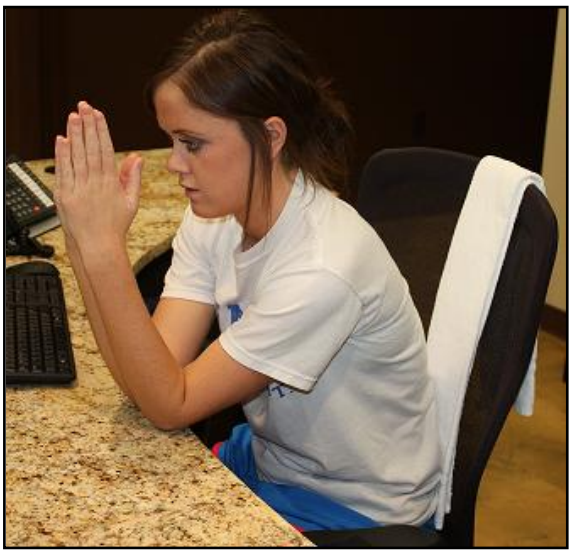
1. Lie on your back with your feet placed on a 2-inch block.
2. Place a band around your knees.
3. Start with your knees together and place your arms at your side with your elbows bent at a 90-degree angle.
4. Inhale through your nose as you turn your knees and hands out to the side keeping your elbows at your side.
5. Exhale through your mouth as you bring your knees and hands back together slowly. At the end of exhalation, perform a pelvic tilt so that your tailbone is raised slightly off the mat. Keep your back flat on the mat.
6. Continue the sequence of inhalation while bringing your hands and knees out and exhalation bringing your hands and knees in.
7. Perform a pelvic tilt at the end of each exhalation.
8. Concentrate on filling your chest more with each inhalation using your diaphragm not your neck.
9. Relax and repeat this sequence 4 more times.

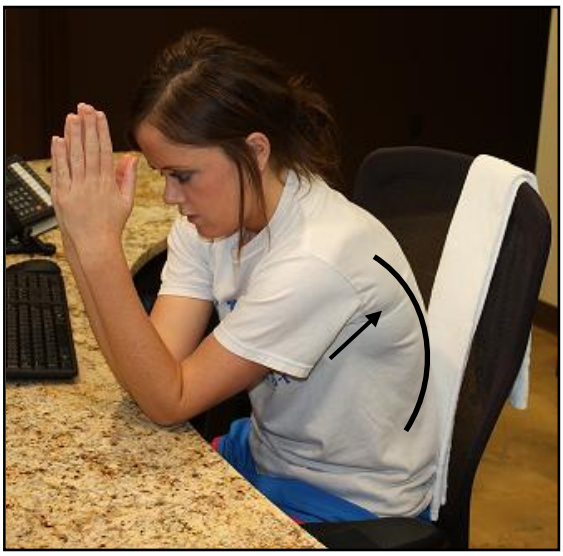
Prone Bilateral Apical Expansion with HG ER

1. Lie on your stomach with one or two pillows under the mid to lower trunk and a small towel roll placed under your forehead to eliminate pressure placed on the nose.
2. Place another pillow or towel roll under the front of your ankles to eliminate pressure on your feet and toes.
3. Bring your arms up and place your elbows by the sides of your head. Bend your elbows and place your palms together. **If you are unable to perform this step, continue to add pillows underneath the trunk, and try again to bring your elbows to the side of your head as your palms come together.*
4. Inhale slowly through your nose and slowly expand your chest, as you slightly bring your palms and fingers away from each other, while keeping your elbows at the side of your head.
5. Pause 3 seconds and then exhale through pursed lips as you hold your hands away from each other, in the previous inhalation state.
6. Pause 3 seconds and then inhale again through your nose, while attempting to fill your chest further as your hands continue to move slightly out and away from each other, without your elbows leaving the side of your head. Sense this expansion without neck involvement.
7. Pause 3 seconds and then exhale as before. Repeat the inhalation and exhalation cycle one more time. Your neck and head should remain relaxed during this entire sequence.
8. At the end of the 3rd exhalation, allow your hands to move back towards each other.
9. Relax and repeat 4 more times.

The goal is to become flexible and diaphragmatically strong enough to repeat the above sequence with your arms parallel to your trunk, or simply put, at the level of your ears, without shoulder pain or arching your back. If you have a number of pillows under your trunk, remove all but two and perform the technique again. When comfortable, add a folded towel under each elbow. By placing rolled up towels under your elbows to match your arms horizontal alignment with the floor and your trunk, your arms will be at complete flexion without losing back and neck neutrality.

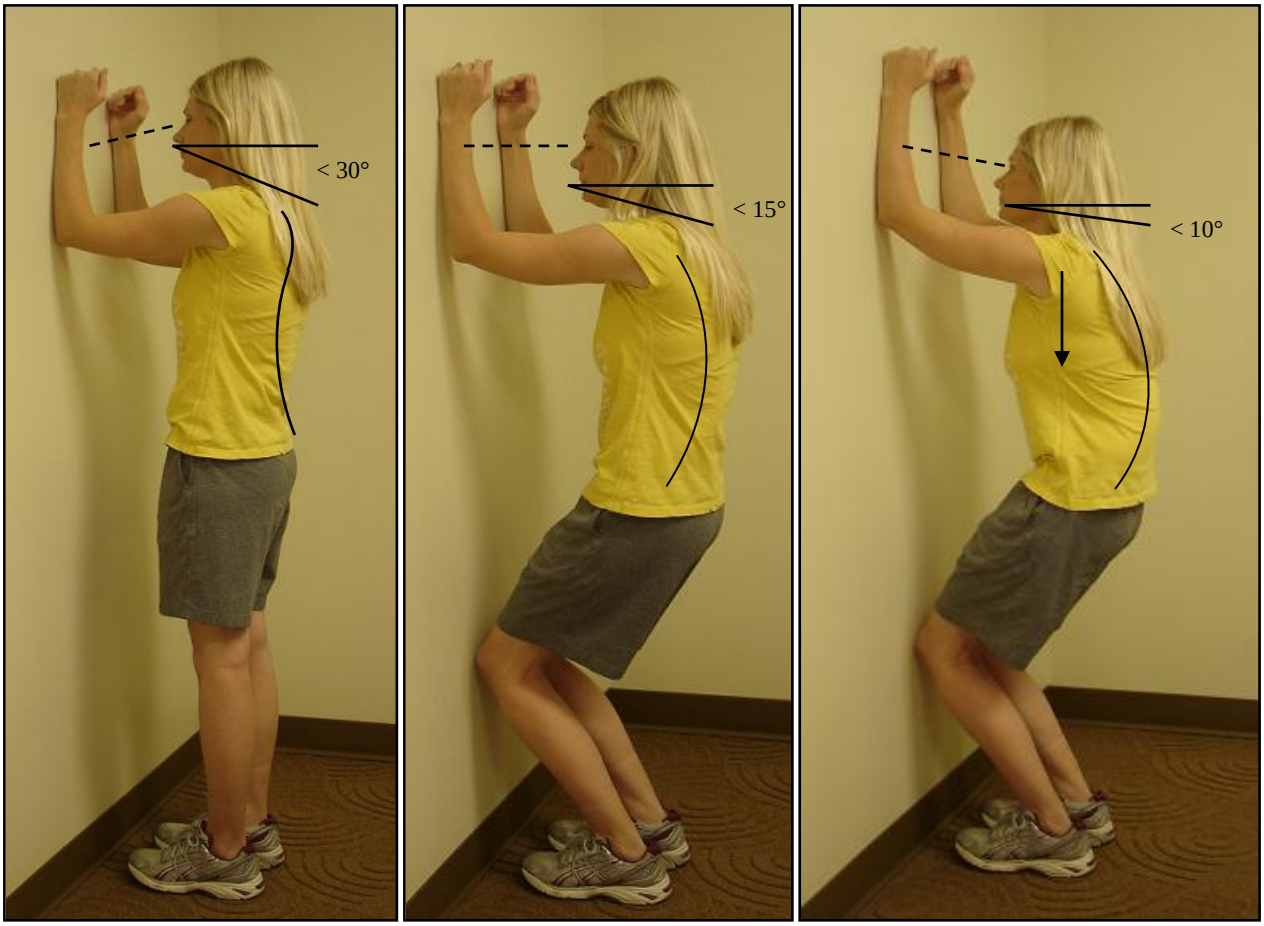
Seated Supported Bilateral Posterior Mediastinum Expansion with Subscapularis Stretch





1. Sit in a chair with your knees at or slightly above hip level.
2. Round out your back and place both elbows on a desk or table in front of you. Keep your elbows and forearms together. You will feel a stretch in both shoulders.
3. Inhale through your nose as you attempt to "fill" or expand your upper back with air. You should feel your upper back ribs "pull away" from your body as the air expands into this region.
4. Exhale through your mouth as you maintain this position.
5. Hold this position while you take 4-5 deep breaths, in through your nose and out through your mouth, attempting to "fill" or expand your upper back with air upon each inhalation.
6. Relax and repeat 4 more times.

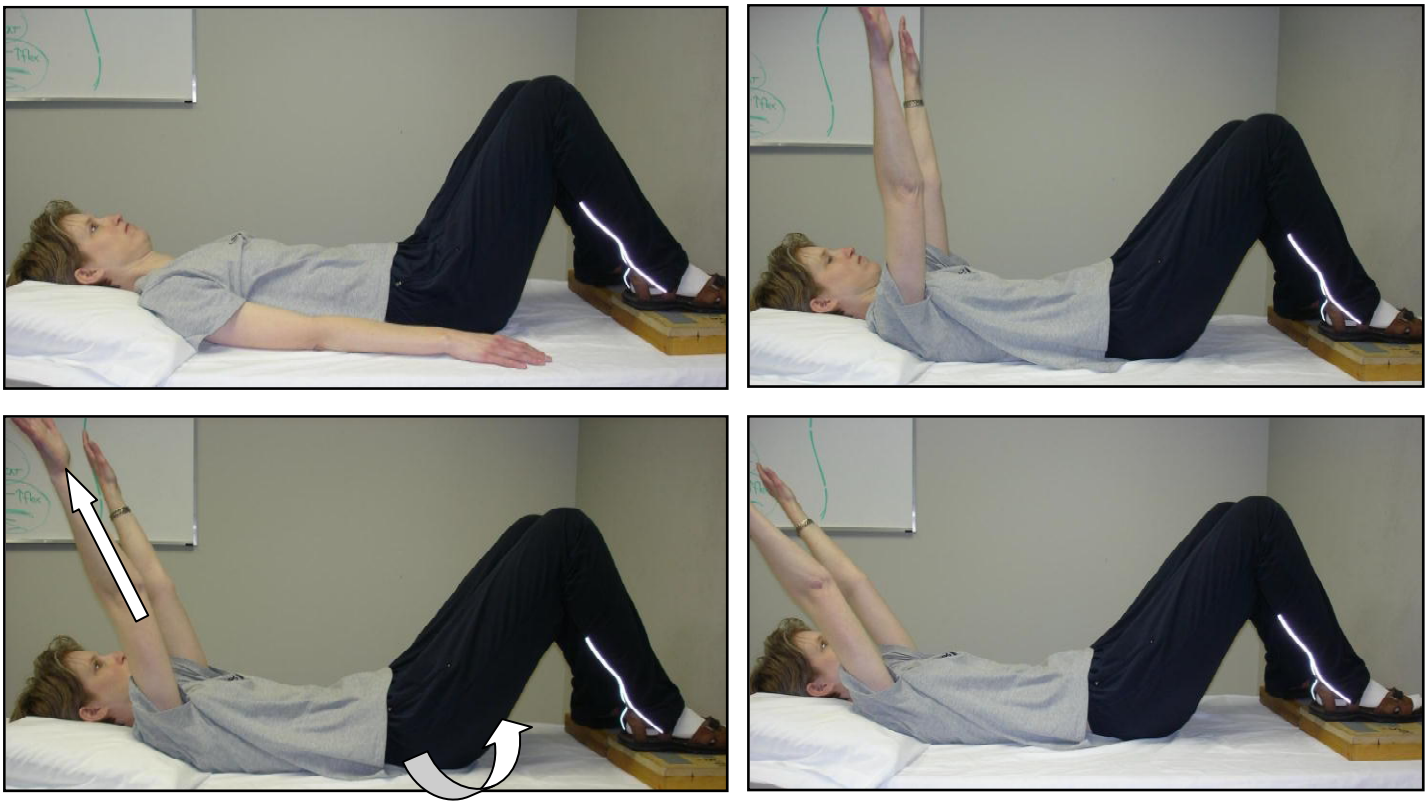
Standing Serratus Stomatognathic Squat



1. Stand facing a wall with your toes pointed forward.
2. Bring both elbows to shoulder level, and bend both arms at a 90-degree angle.
3. Keep your palms facing each other, and press your elbows into the wall.
4. Keeping your elbows pressed into the wall, round your back by tucking your bottom under you and begin to squat by bending your knees.
5. Without letting your arms move, continue to squat until your knees touch the wall. Do not let your heels come off the floor. You should feel the muscles underneath your shoulder blades and on the front of your thighs engage.
6. Slide your arms down as necessary to keep a 90-degree angle at your elbows.
7. With your back rounded, look straight ahead so that your eye level is horizontal with the floor. Keep your heels on the floor and take a breath in through your nose filling the back of your chest wall with air. Exhale through your mouth as you hold the position.
8. Keeping your eyes fixed on the wall, attempt to further round out your back as your head tilts back and chin tilts up. Your eyes should be slightly up at this point.
9. Open and close your mouth, attempting to feel all your teeth upon closure. Keeping your teeth together, breathe in through your nose and out through your mouth.
10. Begin to stand up by pushing slowly through your heels.
11. Relax and repeat 4 more times.

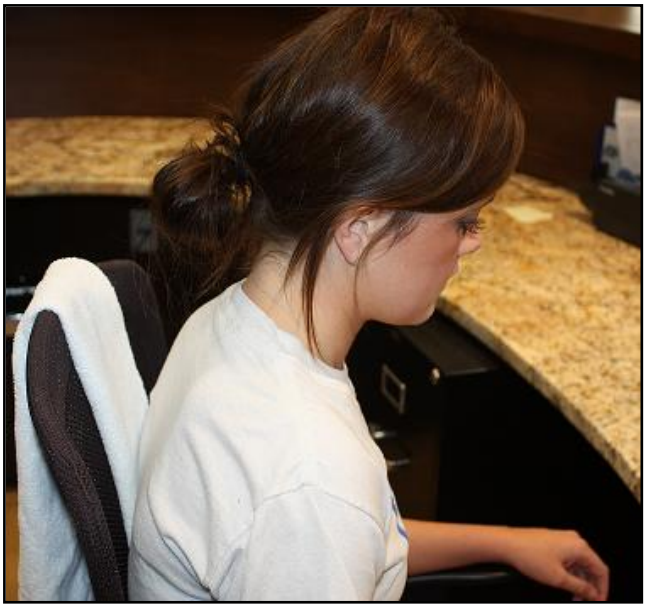
Reference Center(s): Left abdominals, Left heel, Right arch

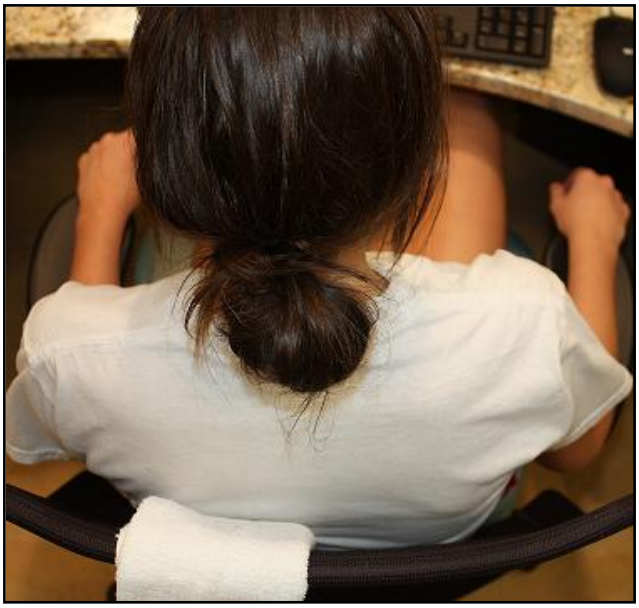
Supine Hooklying T8 Extension



1. Lie on your back with your feet on a 2-inch block.
2. Inhale through your nose and as you exhale through your mouth, push down with your heels and perform a pelvic tilt so that your tailbone is raised slightly off the mat. Keep your back flat on the mat. You should feel the muscles on the back of your thighs engage. As you are performing the pelvic tilt reach towards the ceiling with both of your arms.
3. Maintaining the position of your arms and hips, inhale and fill your upper chest with air as you keep your low back flat on the mat. Let your arms passively move towards your head as you inhale.
4. Exhale and let your lower ribs sink down keeping your arms and hips stationary.
5. Inhale again filling your upper chest with air and let your arms move further towards your head upon inhalation.
6. Exhale and let your lower ribs sink down further and keep your low back on the ground.
7. Continue this sequence for one more breath in and out letting your arms move back further upon inhalation without letting your ribs come up.
8. Relax and repeat 4 more times.

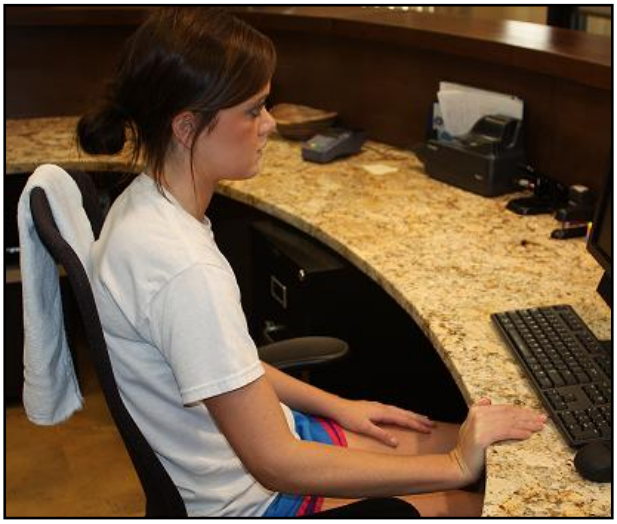
Seated Left Posterior Mediastinum Expansion





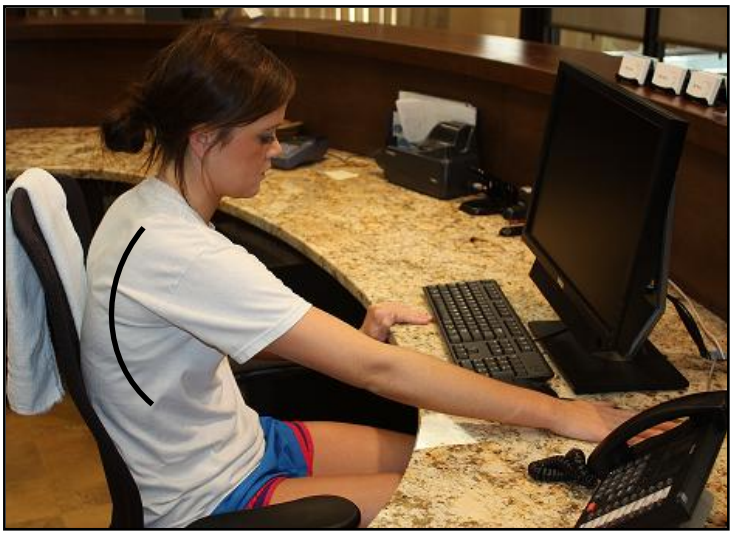
1. Sit in a chair with your knees at or slightly above hip level.
2. Place a small folded towel behind your left upper back. You should no longer feel any support from the chair on your right upper back (shoulder blade area).
3. Maintain this position as you work at your desk or computer, always trying to be aware of your left upper back on the towel.
4. Occasionally take a deep breath of air in through your nose, attempting to fill or push your upper back into the towel roll. Exhale and maintain the position.

Seated Supported Respiratory Left Posterior Mediastinum Expansion with Right Low Trap and Tricep



1. Sit in a chair with your knees at or slightly above hip level.
2. Place a small folded towel behind your left upper back. You should no longer feel any support from the chair on your right upper back (shoulder blade area).
3. Place your right hand on a desk or table in front of you, and keep your left hand resting on your leg.
4. Inhale through your nose and gently press your right hand into the surface, as your left upper back pushes into the towel. Attempt to "fill" or expand your left upper back with air.
5. Exhale through your mouth as you maintain this position.
6. Repeat this breathing sequence for a total of 4-5 deep breaths.
7. Relax and repeat 4 more times.

Seated Supported Respiratory Left Posterior Mediastinum Expansion



1. Sit in a chair with your knees at or slightly above hip level.
2. Place a small folded towel behind your left upper back. You should no longer feel any support from the chair on your right upper back (shoulder blade area).
3. Round out your back as you place your right arm straight on a desk or table in front of you, and your left hand on the edge of the surface with your elbow bent.
4. Stabilize by gently pressing your left hand into the surface as you inhale through your nose, and reach/slide your right arm forward on the surface. Attempt to "fill" or expand your left upper back with air, as it pushes back into the towel.
5. Exhale through your mouth as you maintain this position.
6. Repeat this breathing sequence for a total of 4-5 deep breaths.
7. Relax and repeat 4 more times.

Single Leg Right Apical Overhead Reach

1. Stand on your left leg, and hike your right knee so that your right foot is off the ground. Keep your left knee slightly bent.
2. Keep your left arm down to your side.
3. Reach straight up into the air with your right arm.
4. Inhale through your nose and exhale through your mouth as you reach towards the ceiling with your right hand.
5. Inhale again and exhale as you reach further with your right hand. You should feel your left outside hip (buttock) engage and your right chest wall opening up.
6. Continue this breathing sequence until you have completed 4-5 deep breaths in through your nose and out through your mouth.
7. Relax and repeat 4 more times.

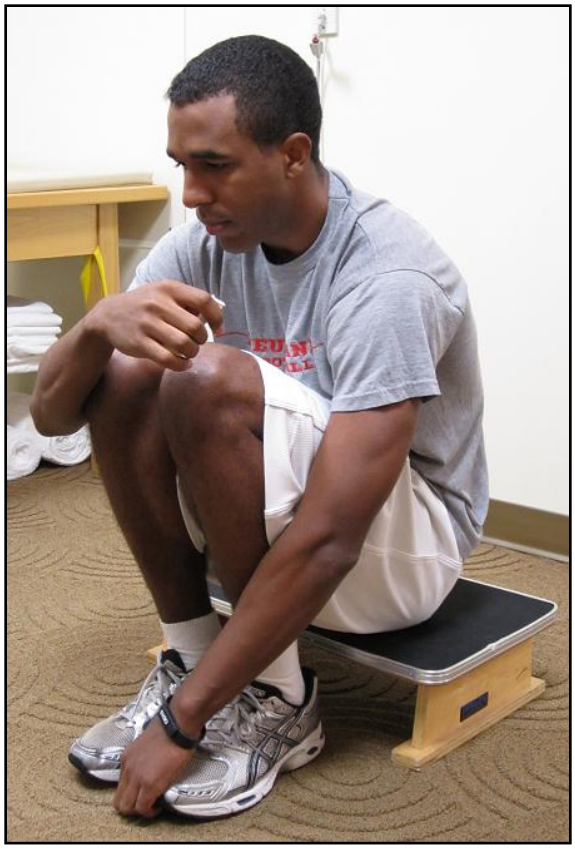
Reference Center(s): Left abdominals, Left heel

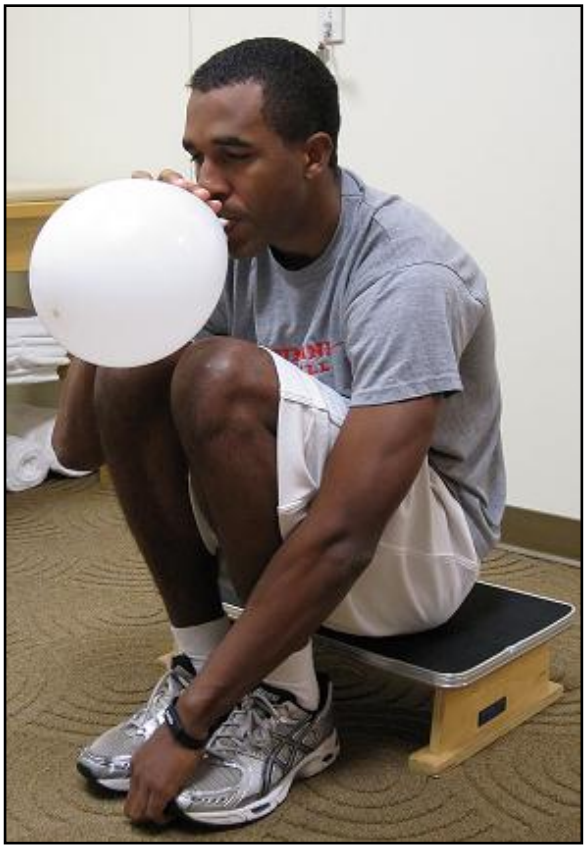
Sternal Positional Stretch

1. Lie on the floor or an elevated surface with your lower legs supported and your upper trunk (hips to shoulders) resting on a 2 ½ inch Airex pad or a firm blanket.
2. With your head and neck unsupported, bring your head to neutral by moving your chin down slightly.
3. Keep your arms at shoulder level and lower them over the elevated surface. You should feel a stretch through the front of your chest wall.
4. Maintain this position for 20-30 minutes as you concentrate on deep exhalation. Pause 4-6 seconds before each inhalation phase without using your neck to inhale. Feel your low back flatten as you sigh out the air.

Airex pad dimensions: 20" length x 16.4" width x 2 ½" height.

Stair Short Seated Balloon





1. Sit on a 6-inch step with your feet together, knees bent and knees together.
2. Round out your back and roll your pelvis back, feeling your "sit bones."
3. Inhale through your nose and slowly blow out into the balloon.
4. Pause three seconds with your tongue on the roof of your mouth to prevent airflow out of the balloon.
5. Without pinching the neck of the balloon and keeping your tongue on the roof of your mouth, take another breath in through your nose.
6. Slowly blow out again as you stabilize the balloon with your hand.
7. Do not strain your neck or cheeks as you blow.
8. After the fourth breath in, pinch the balloon neck and remove it from your mouth. Let the air out of the balloon.
9. Relax and repeat the sequence 4 more times.

Reference Center(s): Left abdominals, Left sit bone, Left heel, Right arch

Latissimus Hang with Balloon

1. Place a balloon in your mouth and grasp onto an overhead bar.
2. Keeping your feet shoulder width apart, place them slightly in front of you and lower your body until all of the slack is taken up through your trunk.
3. Perform a posterior pelvic tilt by tucking your bottom under you. You should feel a stretch in your armpit area and across the front of your chest.
4. Maintaining this position, inhale through your nose and slowly blow out into the balloon. Your ribs should feel like they are moving down as you exhale.
5. Pause 3 seconds with your tongue on the roof of your mouth to prevent airflow out of the balloon and to prevent the balloon from falling out of your mouth.
6. Inhale again through your nose.
7. Slowly blow out again as you stabilize the balloon with your lips. Do not strain your neck or cheeks as you blow.
8. After the 4th breath in, slowly stand up and remove the balloon from your mouth. Let the air out of the balloon.
9. Relax and repeat 4 more times.

Functional Squat with Alternating Reciprocal Crossovers

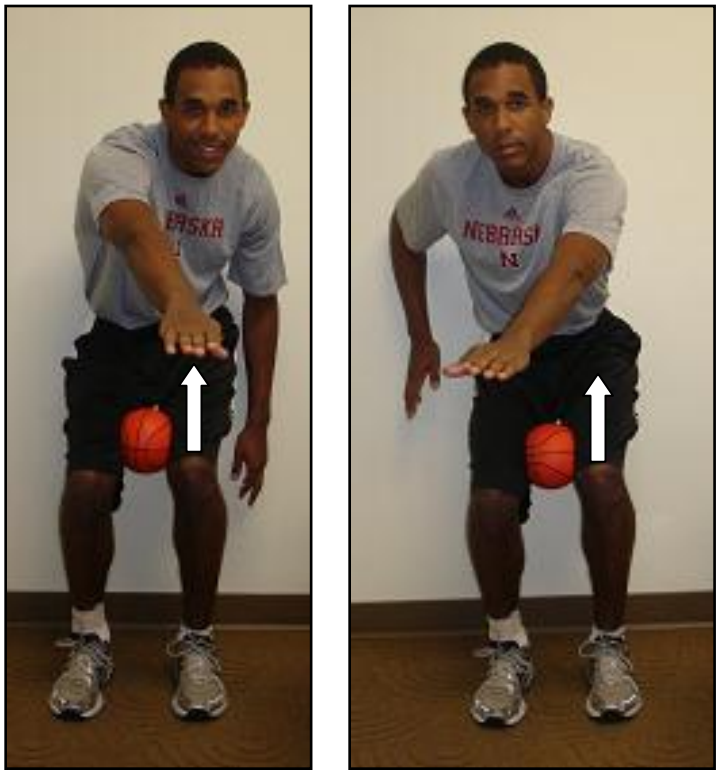
1. Squat down until your knees are maximally bent and attempt to place your rear on your heels as in the above picture. Keep your weight through your heels, not your toes. Your back should be rounded and relaxed.
2. Once you have achieved this squat position, reach forward with your right arm and back with your left, as your trunk or torso is rotating to the left.
3. Inhale through your nose as you reach back with your left arm, maintaining your right arm forward position, and exhale through your mouth as you reach forward with your right arm, maintaining your left arm back position.
4. Repeat for a total of 4-5 breaths.
5. Relax and reverse the sequence of activities as the trunk or torso is rotating to the right. Emphasize chest expansion on the right when you are inhaling and reaching back with the right arm. This position is more difficult to achieve.
6. Repeat for a total of 4-5 breaths.
7. Relax and repeat 4 more times.

Long Seated Alternating Crossovers

1. Sit on the floor and place your hands on your knees. Keep your legs turned in so that your toes are pointed straight towards the ceiling. You should feel your "sit bones." Your back should be straight, not slouched or arched backwards.
2. Keeping your legs straight, move your right leg forward as you reach your left arm towards your right leg. Your right arm should move behind your body so that your trunk rotates to the right.
3. Hold this position, and inhale through your nose as you attempt to "fill" or expand your left upper back with air.
4. Exhale through your mouth as you maintain this position.
5. Move your left leg forward as you reach your right arm towards your left leg. Your left arm should move behind your body so that your trunk rotates to the left.
6. Repeat steps 2-5 until you have advanced each leg forward 4-5 times. Hold and perform the breathing steps in picture number two only, as this position is more difficult to achieve.
7. Relax and repeat 4 more times.

Reference Center(s): Left abdominals, Left sit bone, Left heel

PRI Wall Supported Squat
with Alternating Respiratory Trunk Rotation



1. Stand with your heels 7-10 inches away from the wall.
2. Place a 4-6 inch ball between your knees.
3. Place your bottom on the wall and slide down by slightly bending your knees.
4. Round out your back as you perform a pelvic tilt so that your low back is flat on the wall.
5. Shift your left hip back. Your left knee will be slightly behind your right, and you will feel your left outside hip (buttock), front of your left thigh and left inner thigh engage.
6. Maintaining the above position, reach forward and across the midline of your body with your right hand.
7. Inhale through your nose and as you exhale through your mouth, reach further with your right arm. Repeat this breathing sequence for a total of 3 deep breaths in through your nose and out through your mouth, reaching a little further with your right arm each time you exhale.
8. Now maintaining the above position (left hip shifted back), reach forward and across the midline of your body with your left hand.
9. As you inhale through your nose, reach further with your left arm. Exhale and maintain the reach. Repeat this breathing sequence for a total of 3 deep breaths, in through your nose and out through your mouth, reaching a little further with your left arm each time you inhale. Attempt to fill or expand your left upper back as you inhale.
10. Slowly stand up by pushing through your heels, keeping your lower back flat on the wall.
11. Relax and repeat 4 more times.

Reference Center(s): Left abdominals, Left heel, Right arch

Forward Alternating Reciprocal Resisted Respiratory Reach

1. Place a piece of tubing in each hand with the resistance behind your back. Be sure to look straight ahead during this activity.
2. Shift your left hip back. Inhale through your nose as you advance your left arm and right leg forward. Attempt to fill or expand your left upper back with air upon inhalation.
3. Exhale through your mouth, and place your right foot on the ground. Shift your right hip back.
4. Inhale through your nose as you advance your right arm and left leg forward. Attempt to fill or expand your right upper back with air upon inhalation.
5. Exhale through your mouth and place your left foot on the ground.
6. Continue walking forward with this breathing sequence until you have completed 10 steps.
7. Relax and repeat 2 more times.

Reference Center(s): Left abdominals, Left heel, Right arch