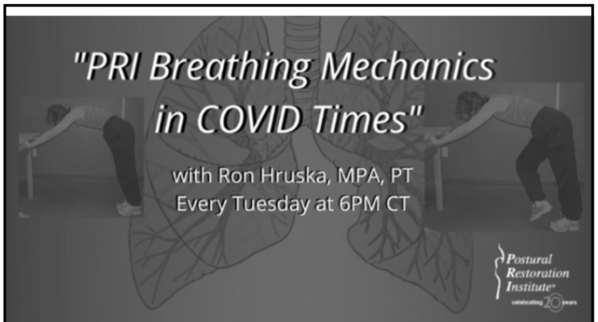

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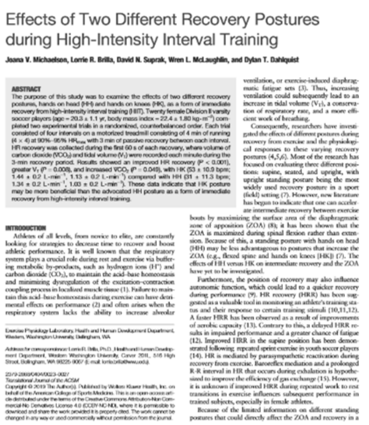
WEEK 9:
ARM SWING INFLUENCE ON ARTERIALIZATION AND AIRWAY OPENING

The effect of arm and body position on respiratory ventilation for pulmonary recovery after strenuous training is well described in the literature.

Leaning forward and placing the hands on the knees leads to a significantly greater ventilation compared with standing with the arms at the sides and standing with the hands behind the head at rest.


Effects of Two Different Recovery Postures during High-Intensity Interval Training

Joana V. Michaelson, Lorrie R. Brilla, David N. Suprak, Wren L. McLaughlin, and Dylan T. Dahlquist

ABSTRACT
The purpose of this study was to examine the effects of two different recovery postures, hands on head (HH) and hands on knees (HK), as a form of immediate recovery from high-intensity interval training (HIIT). Twenty female Division II varsity soccer players (age = 20.3 ± 1.1 yr, body mass index = 22.4 ± 1.80 kg·m⁻²) completed two experimental trials in a randomized, counterbalanced order. Each trial consisted of four intervals on a motorized treadmill consisting of 4 min of running (4 × 4) at 90%–95% HR_{max} with 3 min of passive recovery between each interval. HR recovery was collected during the first 60 s of each recovery, where volume of carbon dioxide (VCO_2) and tidal volume (V_T) were recorded each minute during the 3-min recovery period. Results showed an improved HR recovery ($P < 0.001$), greater V_T ($P = 0.008$), and increased VCO_2 ($P = 0.049$), with HK (53 ± 10.9 bpm; 1.44 ± 0.2 L·min⁻¹, 1.13 ± 0.2 L·min⁻¹) compared with HH (31 ± 11.3 bpm; 1.34 ± 0.2 L·min⁻¹, 1.03 ± 0.2 L·min⁻¹). These data indicate that HK posture may be more beneficial than the advocated HH posture as a form of immediate recovery from high-intensity interval training.

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Arms, however, are also very important in maximizing respiratory perfusion during exercise-induced increased ventilation.

Very little research exists regarding the position and swing of arms during forward locomotor movement, regardless of the body speed, body elevation, or ground elevation.

One of the best studies regarding upper body function (*Control and function of arm swing in human walking and running*, by Herman Pontzer et al, Journal of Experimental Biology 2009), support the postulate that the trunk and shoulders act primarily as elastic linkages and act as passive mass dampers which reduce torque on the head and neck.

This last webinar in this series, will focus on the value of arm swing for reducing the ventilatory demands on you and your body during strenuous exercise.

Actively moving your arms is not only an essential part of active walking, it is also an essential part of active arterialization.

Also, passive movement of your arms improves ventilatory elasticity.

One study (*Improvement of pulmonary function with arm swing exercise in patients with type 2 diabetes,* by Orathai Tunkamnerdthai et al, Journal of Physical Therapy Science 2015), demonstrated how “arm swing exercise” improves pulmonary functions via improvement of hyperglycemia, antioxidant activity, and fat metabolism.

If you recall in week 1 of this webinar series, I stated that "Changes in posture secondary to position of ease and comfort or habitual patterning, changes perfusion and ventilation positions, and patterns of arterialization."

There probably is nothing that re-positions, nor re-centers, patterns of ventilation and perfusion better than our two arms. Our TWO arms.

Arms that swing off each other increase lateralization of the ribcage, abdominals and intercostals and therefore, improves arterialization at the distal arterioles of our lungs.

Argumentatively, our best "personal" trainer are our two arms.

We want our lungs, especially our lower lungs, to change positions, wring and unwring.

This movement is not necessarily a shoulder function.

It is produced by both shoulder and mid to upper thoracic reciprocal function and accompanying rib cage alternating lateralization.

"In normal breathing, alveolar pressure must be less than atmospheric pressure during inhalation, and greater than atmospheric pressure, as the chest recoils, during exhalation." (Week 1)

"The most common site of limitation is the right anterior apical lobe and the left posterior based lobe."

The most common site of limitation of arm movement or swing is at the mid lateral chest walls.

Bipedal Arm Swing Respiratory Considerations

1. Arm swing, counters twisting motion on the mid to low thorax created by the legs, for efficient ventilation and forward, straight ahead, movement.

2. Uneven arm swing results in over-rotation of the trunk resulting in wasted energy and inefficient overuse of the upper torso and thorax; and inefficient arterialization from the lower lobes of the static lung tissue.

3. Arm swing should be rhythmic and similar to a pendulum, providing a source of pumping air in and out of the lung and around the bronchioles.

   It also keeps the smooth muscle around the bronchioles, elastic.

4. The angle of the lower arm and upper arm at the elbow should be approximately 90 degrees and may increase slightly as they are swung straight back.

   The increase of the angle at the elbow during take back allows for the opposite leg to complete its cycle of movement backward.

Bipedal elbow angulation should decrease on forward movement from backward movement angulation values, to prevent elevation of the shoulder complex from overuse of neck and back extensors.

These elbow considerations, should enhance hemi-rib alternation and move blood and gas around arterioles, decrease arteriole smooth muscle vascular resistance and increase lung capillary flow.

5. Arm swing reduces negative intrathoracic pressure swings and vertical angular movement (body moving up and down during forward locomotor movement), by maintaining wrist extension (not wrist pumping) and ankle dorsiflexion necessary for forward locomotor movement. (Week 7)

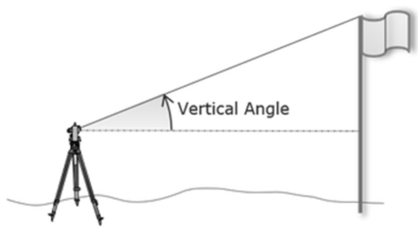

Figure F-1
Angle Orientation

Image from: http://www.jerrymahun.com/index.php/home/open-access/i-basic-principles/85-i-f-vert-angles

Surveying

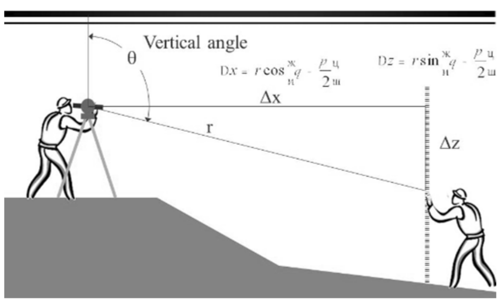

Image from: https://slideplayer.com/slide/5054633/16/images/31/Surveying+Vertical+angle+q+Dx+r+Dz.jpg

6. Head and neck rotation effort for torso and thoracic direction (Head on Body reflex) is reduced by the influence arm swing has on the upper thorax to the lower thorax rotation.

   This influence on the mid to low thorax (T8 and below) decreases accessory respiration from T8 and above, including the neck.

7. Most optimal arm swing for respiratory and postural balance is .8 m/s (meter per second) which is 1.79 miles per hour.

8. Passive arm swing has been shown to effectively act on the spinal column and shoulders as a spring.

   The more active the elbow becomes, the more active the shoulders become and the more "stiff" the "spring" becomes between the pelvis, shoulders, and arms, resulting in poorer ventilatory perfusion.

9. When the inertia of movement is decreased, arm swing is set in motion, the amplitude of the shoulder and rib rotation increases.

   This biomechanically allows the intercostals to expand and integrate intercostal intrinsic ‘intelligence’ during walking respiration or running respiration. (Week 7)

10. Arm swinging, and associated body movement, is a self-tuned and self-stabilizing phenomenon that reduces multi-segment, multi-muscle, and multi-system disassociation and enhances physiology and physical association through the rib cage and underlying respiratory function.

Racewalking

There are two rules that govern racewalking.

1. The first dictates that the athlete’s back toe cannot leave the ground until the heel of the front foot has touched. Violation of this rule is known as ‘loss of contact’.

2. The second rule requires that the supporting leg must straighten from the point of contact with the ground and remain straightened until the body passes directly over it.

Athletes stay low to the ground by keeping their arms swinging low, close to their hips.

If one sees a racewalker's shoulders rising, it may be a sign that the athlete is losing contact with the ground.

This position of walking reinforces abdominal, intercostal, inter-scapula and subscapular alternation during alternation of zones of apposition (Weeks 5 and 6), zones of ventilation (Week 1) and associated desired arterialization. (Week 2)

Qigong Arm Swing
YouTube Suggestions

First Form: Waist Rotation with Swinging Arms
(0:00 to 1:16)

Fifth Form: Arm Swing with Bending Knees
(0:00 to 1:36)

Counter Swing – Qigong Exercise
(0:45 to 1:33)

Other Qigong YouTube Video Recommendations

Benefits of Qigong – Energy Gates Qigong and Tai Chi (35:42)

Qigong to Open the Chest and Shoulders, Stretch the Spine and Improve Flexibility by KSeny (8:34)

Qigong Chest and Lungs Opening Exercise by KSeny (3:22)

Thank you for joining Jen and I over the last 9 weeks. We hope this information will help anyone and everyone, who watched or will watch in the future, better understand the relationships between lung and chest function, Postural Respiration guidelines and techniques taught by the Postural Restoration Institute® and breathing mechanics during and after COVID times.

Gratefully yours,

Ron Hruska