CLASS 2

OXYGEN ADVANTAGE®

BY PATRICK MCKEOWN

INCREASING AEROBIC UPTAKE

Slow Breathing

- Tidal volume: the normal volume of air entering the lungs during one inhale at rest
- Respiratory rate: The number of breaths per minute
- Minute ventilation: the volume of air which enters the lungs over one minute.
- RR * TV= MV

Slow Breathing

- Enhances ventilation efficiency and arterial oxygenation via alveolar recruitment, and distension and reduction of alveolar dead space.

- Bilo G, Revera M, Bussotti M, *et al. Effects of slow deep* breathing at high altitude on oxygen saturation, pulmonary and systemic hemodynamics. *PloS one 2012; 7: e49074*

Slow Breathing- 20% increase to breathing efficiency

- Of every breath taken into the body, 150ml remains in dead space.
- Mouth: 12 * 500 = 6 litres
- Alveoli: 12* (500-150) = 4.2 litres
- Nose: 6 * 1000 = 6 litres
- Alveoli: 6 * (1000-150) = 5.1 litres
- Sports, calm, climbing altitude, respiratory or cardio disorder

Slow Breathing

- Nasal breathing- more likely to breathe deeper into lungs
- Nasal nitric oxide- redistributes blood throughout the lungs
- Improves ventilation perfusion to improve oxygen uptake in the blood

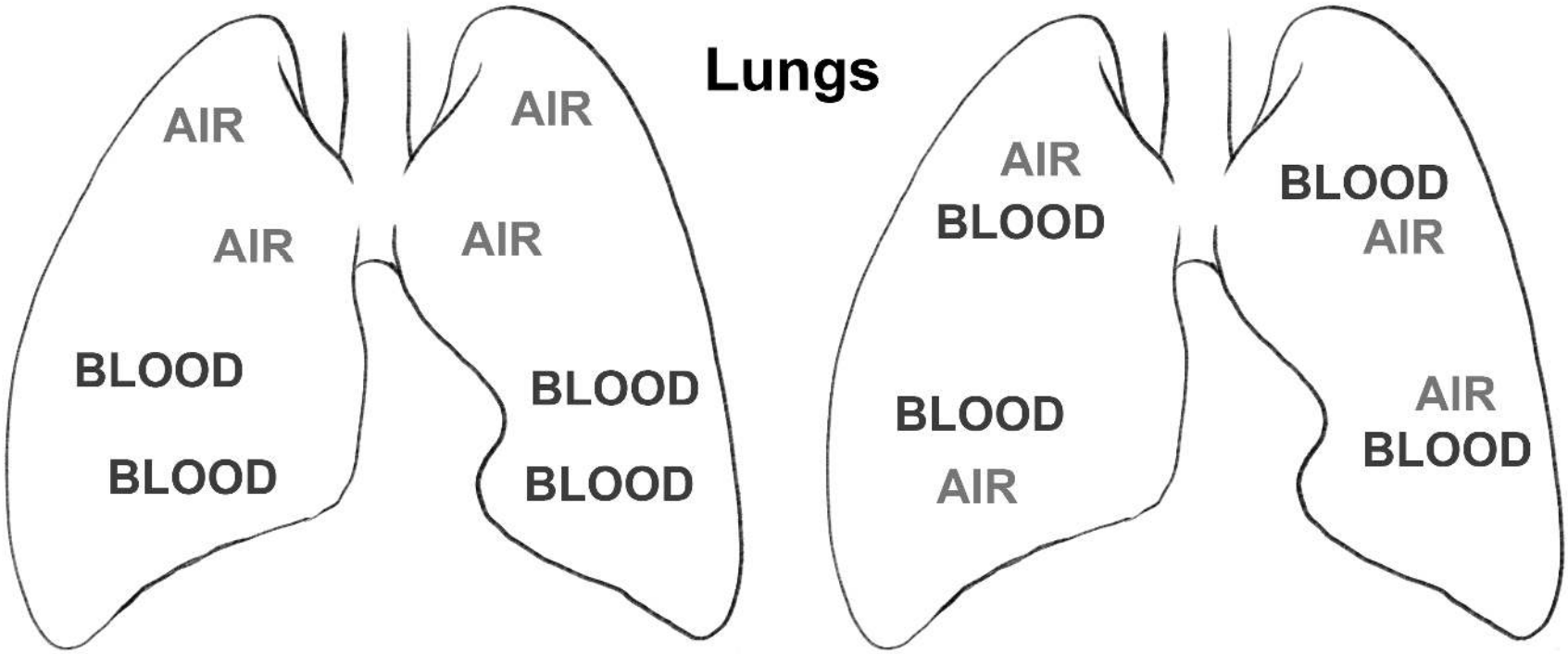
Slow Breathing

- Total lung capacity, functional residual capacity, and residual volume decreased significantly with total nasal obstruction.
- These findings imply that the resistance to expiration provided by the nose helps maintain lung volumes and so may indirectly determine arterial oxygenation.

- Swift AC, Campbell IT, McKown TM. Oronasal obstruction, lung volumes, and arterial oxygenation. Lancet. 1988 Jan 16;1(8577):73-5.

Shallow-Fast Breathing

Slow-Deep Breathing



Slow Breathing

- Training aimed at a permanently slow breathing rate reduces dyspnoea and improves exercise performance.

- Bernardi L, Spadacini G, Bellwon J, Hajiric R, Roskamm H, Frey AW. Effect of breathing rate on oxygen saturation and exercise performance in chronic heart failure. Lancet 1998; 351:1308±1311.

Nasal Versus Oral Breathing

NASAL VERSUS ORAL BREATHING

- Few individuals choose spontaneously to breathe in a nasally restricted manner during heavy exercise (Saibene et al., 1978).

- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X

NASAL VERSUS ORAL BREATHING

- Those not adapted to nasally restricted breathing during exercise experience an unacceptable sensation of air hunger at some level of intensity, causing them to switch over to an oral breathing pattern at a relatively low ventilation rate, thereby reducing PETCO2 and air hunger for a given level of exertion.
- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X

NASAL VERSUS ORAL BREATHING

- LaComb et al., 2017 suggests that healthy individuals can breathe entirely nasally at the lower levels of work necessary to improve aerobic fitness in healthy normal populations without any specific adaptation to the process.

- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X

NASAL VERSUS ORAL BREATHING

- 5 males, 5 females recreational who utilized a nasally restricted breathing pattern during all training and racing for a minimum of 6 months.

- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X

NASAL VERSUS ORAL BREATHING

- Respiratory Rate 39.2 (nasal) 49.4 (oral)
- Increased EtCO2mmHg 44.7 (nasal) 40.2 (oral)
- Ventilation (nasal) reduced by 22%
- Decreased PETO2 and FEO2 in their expired air at VO2max

- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X

NASAL VERSUS ORAL BREATHING

- Partial pressure of oxygen was reduced at the end of each exhalation (PETO2) indicating that a larger volume of oxygen was removed during nasal breathing.

- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X

NASAL VERSUS ORAL BREATHING

- Participants utilized a nasally restricted breathing pattern over a minimum of 6 months prior to the study.
- Subsequently, these participants were able to achieve the same peak work and maximal oxygen consumption in a GXT while breathing nasally that they achieved while breathing orally.

- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X

NASAL VERSUS ORAL BREATHING

- Able to achieve adequate oxygenation to work rates as high as in oral breathing- by allowing a greater time for diffusion with each breath.

- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X

NASAL VERSUS ORAL BREATHING

- As VE is produced by muscular work, a reduced VE logically reflects a reduced work of breathing which might result in a reduced gross metabolic cost during exercise, further resulting in a small improvement in gross economy.

- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X

NASAL VERSUS ORAL BREATHING

- Lower VO2 may be due to less metabolic energy production to produce the same external work is more physiologically economic as a result.

- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X

NASAL VERSUS ORAL BREATHING

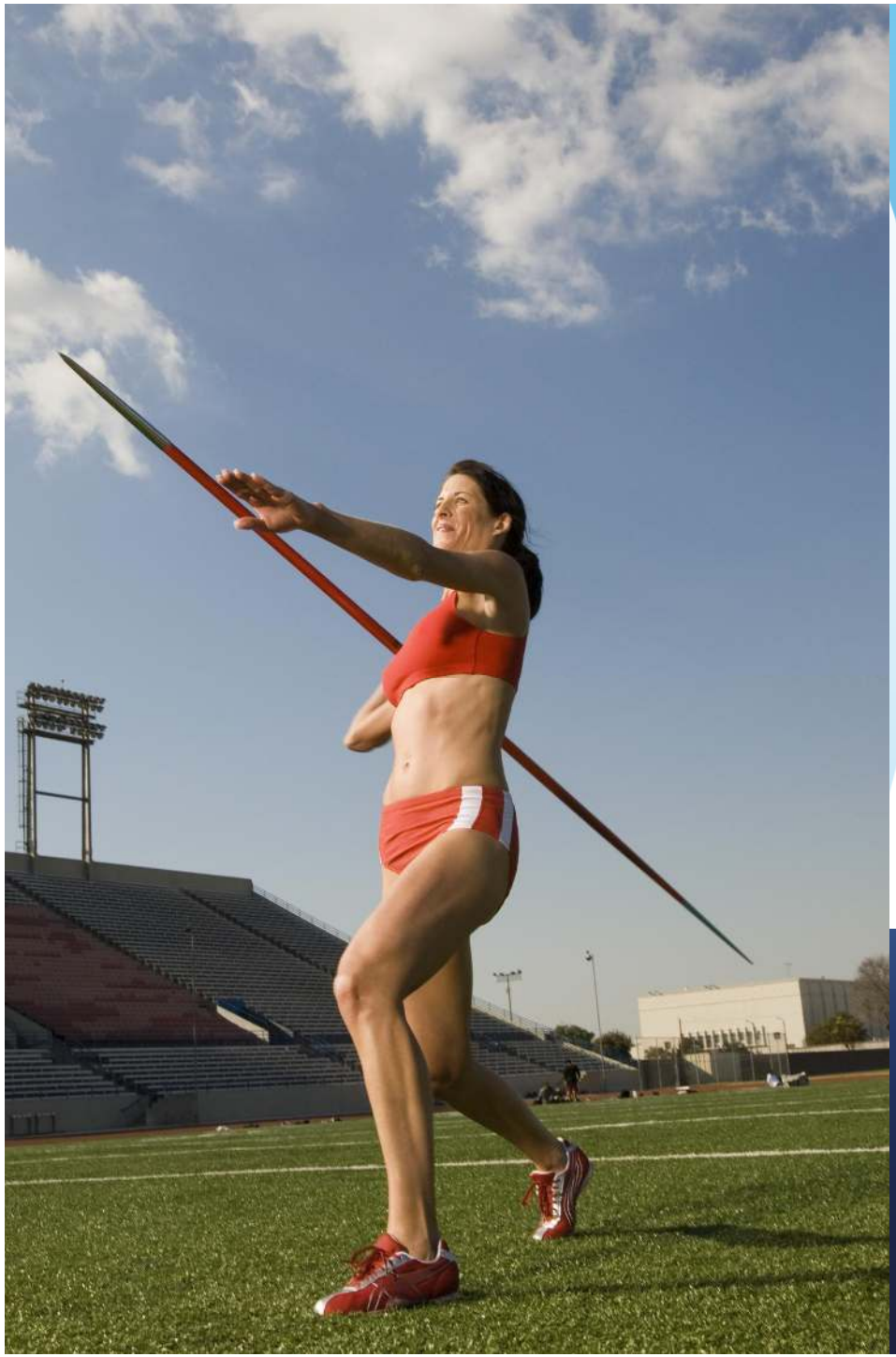
- Nasally restricted breathing during exercise might be viewed as a potential way to improve performance in endurance events whereby economy is a critical performance factor (Joyner & Coyle, 2008).

- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X

NASAL VERSUS ORAL BREATHING

- Data suggests that sustained exposure to breathing conditions that increase PETCO2 and air hunger over normal also results in a loss of air hunger over time (Bloch-Salisbury et all., 1996)

- George M. Dallam et al. Effect of Nasal Versus Oral Breathing on Vo2max and Physiological Economy in Recreational Runners Following an Extended Period Spent Using Nasally Restricted Breathing. International Journal of Kinesiology & Sports Science. ISSN: 2202-946X



NASAL BREATHING WORKLOAD

WORKLOAD

- During exercise, nasal breathing causes a reduction in FEO_2 (fraction of expired air that is oxygen (O_2%)), indicating that on expiration the percentage of oxygen extracted from the air by the lungs is increased.

- *Morton, King, Papalia 1995 Australian Journal of Science and Medicine in Sport. 27, 51-55*

WORKLOAD

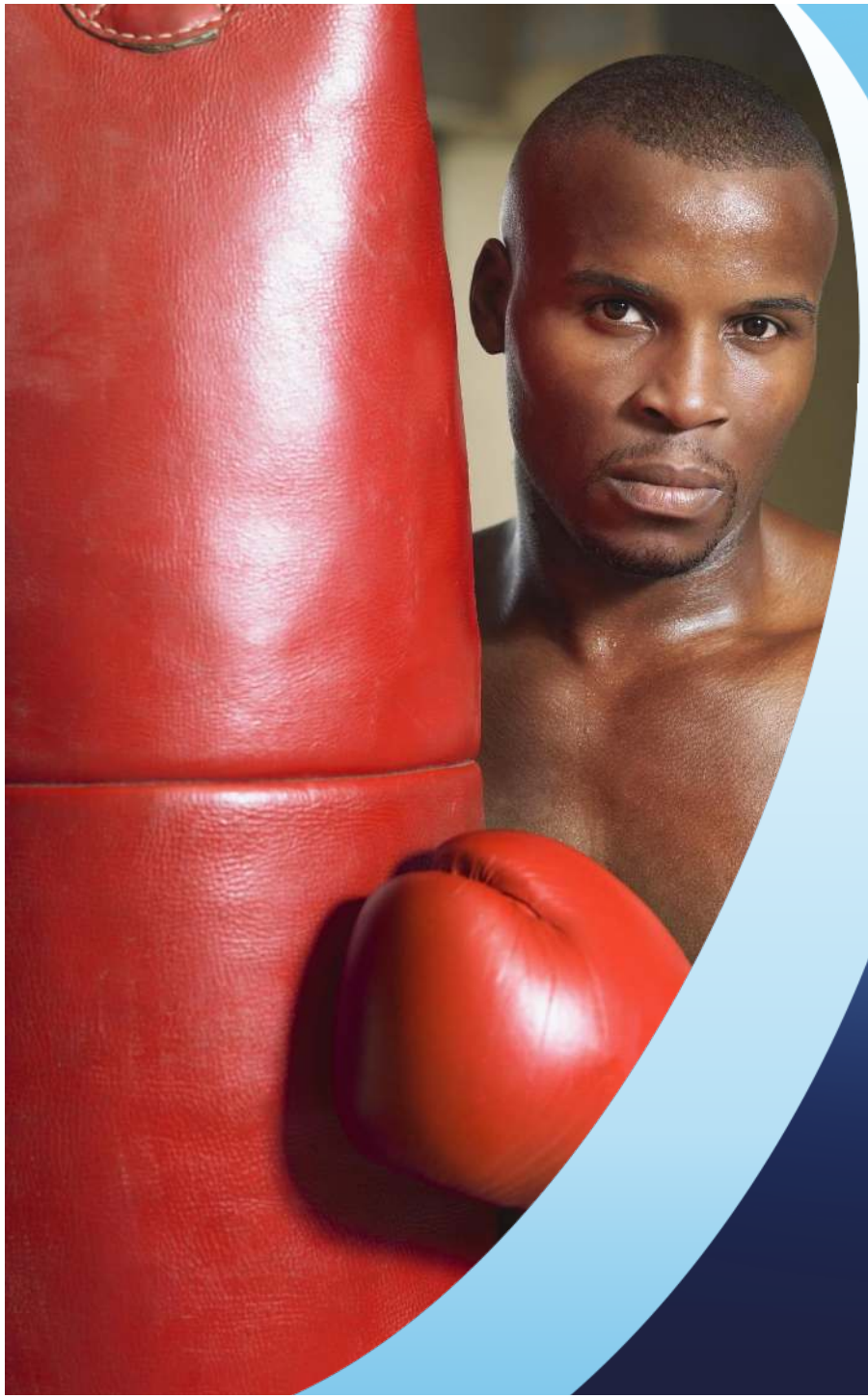
- Maximal exercise intensity that could be achieved by healthy subjects while nasal breathing
- On average subjects could reach 90% of their max workload while nasally breathing (at least for the short period during the test).

Thomas, S. A., Phillips, V., Mock, C., Lock, M., Cox, G. and Baxter, J. (2009) The effects of nasal breathing on exercise tolerance. In: *Chartered Society of Physiotherapy Annual Congress 2009*

WORKLOAD

- 12 healthy physiotherapy students aged between 21 and 27 (8 male and 4 female) completed both runs. Nasal breathing was continued to 85% of V02 peak achieved indicating that people are capable of nose breathing at much higher intensities than they would normally chose to do.

Thomas, S. A., Phillips, V., Mock, C., Lock, M., Cox, G. and Baxter, J. (2009) The effects of nasal breathing on exercise tolerance. In: *Chartered Society of Physiotherapy Annual Congress 2009*



NOSE VERSUS MOUTH

POOR NASAL FUNCTION

- Narrow nostrils - resistance to breathing will be too much during physical exercise
- Wear nasal dilator to reduce resistance
- Recommended: TheTurbine Nasal dilator

BREATHE EFFICIENTLY

- Maintaining nasal breathing is much easier during exercise, if you breathe efficiently. Breathe slow, light and deep.
- **Slow**: reduce respiratory rate
- **Light**: ensure you are not overbreathing
- **Deep**: increase the size of each breath
- Achieve a **higher BOLT** score, sustained practice nose breathing.

RECREATIONAL ATHLETES

- Nasal breathing at all times
- If you find that your need for air is so great that you need to open your mouth, simply slow down and allow your breathing to calm once more.

COMPETITIVE ATHLETES

- Competitive athletes
- Alternate nasal breathing with mouth breathing.
- High-intensity training helps to prevent muscle de-conditioning and will require an athlete to periodically breathe through their mouth.

COMPETITIVE ATHLETES

- For less-than maximum intensity training, and at all other times, nasal breathing should be employed.
- For example, competitive athletes may spend 50 percent of their training with the mouth closed.

COMPETITIVE ATHLETES

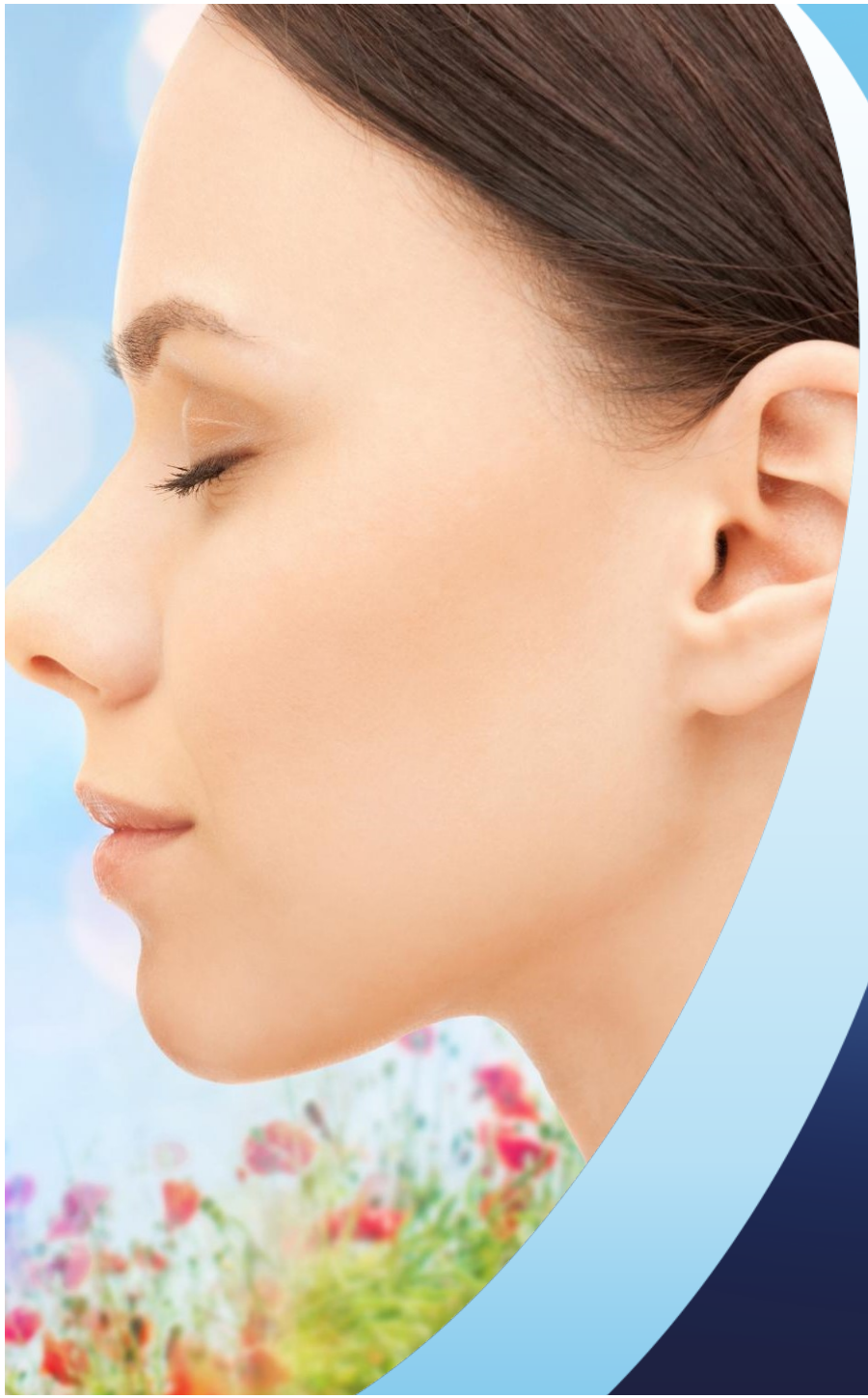
- Also devote training to working at an all-out pace in order to maintain muscle condition, for which brief periods of mouth breathing will be required.

COMPETITIVE ATHLETES

- During competition there is no need to intentionally take bigger breaths.
- Instead, bring a feeling of relaxation to your body and breathe as you feel necessary.
- However, breath-holding exercises during your warm-up can be very advantageous, as can practicing breathing recovery during your warm-down.

COMPETITIVE ATHLETES

- Competition isn't the ideal time to focus about how well or poorly you are breathing, as your full concentration should be devoted to the game. The best way to improve breathing for competition is to improve your everyday breathing, and the key to this is obtaining a higher BOLT score.



EXERCISE INDUCED ASTHMA

EXERCISE INDUCED ASTHMA

- Exercise-induced asthma affects an estimated 4 to 20 percent of the general population and 11 to 50 percent of certain athlete populations.

- *Rundell KW, Im J, Mayers LB, Wilber RL, Szmedra L, Schmitz HR. Self-reported symptoms and exercise-induced asthma in the elite athlete. Med Sci Sports Exerc.2001 Feb;33(2):208-13*

EXERCISE INDUCED ASTHMA

- Routine screening of UK Olympic team before Athens Olympics, the recorded prevalence of asthma was 21%. (double the prevalence rate of the UK population)

- The two sports with highest prevalence was swimming and cycling. (both over 40%)

- *McConnell Breathe Strong, Perform Better*

EXERCISE INDUCED ASTHMA

- Why should asthma be so high in athletes?
- Exercise is believed to trigger bronchoconstriction due to dehydration of the airways. The moisture is ‘sucked out’ of the airway cells causing them to dehydrate.
- Dehydration induces inflammation of the airways.

- *McConnell Breathe Strong, Perform Better*

EXERCISE INDUCED ASTHMA

- 55 percent of football athletes and 50 percent of basketball athletes displayed airway narrowing conducive to asthma, athletes from the sport of water polo showed significantly fewer asthma symptoms.

- *J Strength Cond Res.2012 Jun;(26(6)):1644-50*

EXERCISE INDUCED ASTHMA

- We speculate that asthmatics may have an increased tendency to switch to oral breathing, a factor that may contribute to the pathogenesis of their asthma.

- *Kairaitis K, Garlick SR, Wheatley JR, Amis TC. Route of breathing in patients with asthma. Chest. 1999 Dec;116(6):1646-52.*

EXERCISE INDUCED ASTHMA

- Nasal breathing provides a protective influence against exercise-induced asthma. We hypothesized that enforced oral breathing in resting mild asthmatic subjects may lead to a reduction in lung function.

- *Hallani M, Wheatley JR, Amis TC. Enforced mouth breathing decreases lung function in mild asthmatics. Respirology. 2008 Jun;13(4):553-8.*

EXERCISE INDUCED ASTHMA

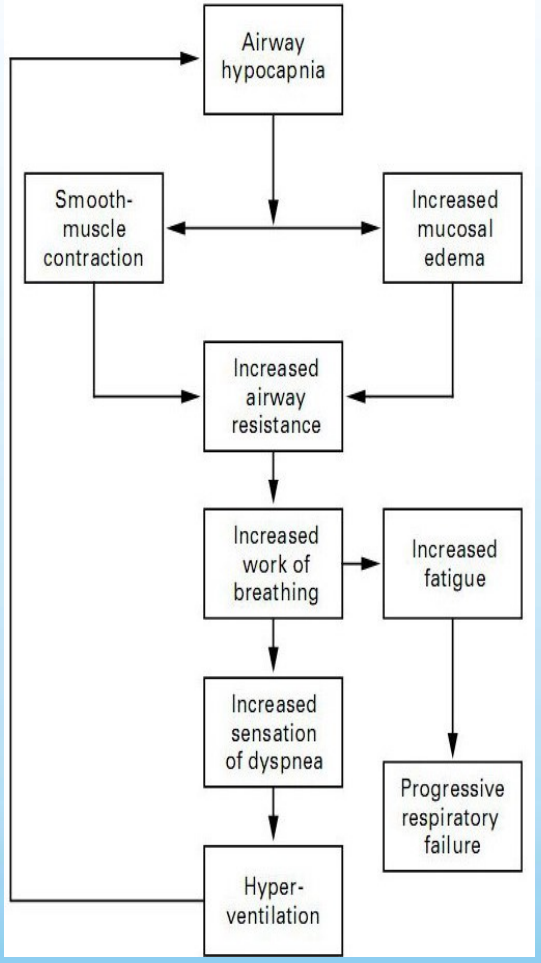
- CONCLUSIONS: Enforced oral breathing causes a decrease in lung function in mild asthmatic subjects at rest, initiating asthma symptoms in some. Oral breathing may play a role in the pathogenesis of acute asthma exacerbations.

- *Hallani M, Wheatley JR, Amis TC. Enforced mouth breathing decreases lung function in mild asthmatics. Respirology. 2008 Jun;13(4):553-8.*

EXERCISE INDUCED ASTHMA

The NEW ENGLAND JOURNAL of MEDICINE

APRIL 9, 2009



Laffey, J. & Kavanagh, B. Hypocapnia, New England Journal of Medicine. 4 July 2002.

EXERCISE INDUCED ASTHMA

- The major cause of exercise induced asthma (EIA) is thought to be the drying and cooling of the airways during the 'conditioning' of the inspired air.

- *Morton, King, Papalia 1995 Australian Journal of Science and Medicine in Sport. 27, 51-55*

EXERCISE INDUCED ASTHMA

- Nasal breathing increases the respiratory system's ability to warm and humidity the inspired air compared to oral breathing and reduces the drying and cooling effects of the increased ventilation during exercise.

- *Morton, King, Papalia 1995 Australian Journal of Science and Medicine in Sport. 27, 51-55*

EXERCISE INDUCED ASTHMA

- This will reduce the severity of EIA provoked by a given intensity and duration of exercise.

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- *Morton, King, Papalia 1995 Australian Journal of Science and Medicine in Sport. 27, 51-55*

EXERCISE INDUCED ASTHMA

- Breathed with their mouths open when instructed to breathe "naturally."
- Breathe only through the nose during the exercise, an almost complete inhibition of the post exercise bronchoconstrictive airway response was demonstrated.
- When instructed to breathe only through the mouth during exercise, an increased bronchoconstrictive airway response occurred.

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Shturman-Ellstein R, Zeballos RJ, Buckley JM, Souhrada JF. The beneficial effect of nasal breathing on exercise-induced bronchoconstriction. Am Rev Respir Dis. 1978 Jul;118(1):65-73.

OTHER CONSIDERATIONS- ASTHMA

- More normal breathing volume leads to less cooling and dehydration of the airways.
- Changing breathing volume towards normal, with a higher BOLT is especially effective at helping to prevent exercise induced asthma and cyclists cough.

SLEEP DISORDERED BREATHING

SLEEP DISORDERED BREATHING

- Snoring is a sound created from turbulent airflow. It is noisy breathing during sleep caused by the exchange of a large volume of air through a narrowed space, which in turn causes the tissues of the nose and throat to vibrate.

SLEEP DISORDERED BREATHING

- Simple snoring - vibration of the soft palate. (mouth snoring)
- High upper airway resistance (HUAR) - turbulent airflow in the nasopharynx and oropharynx causing inspiratory flow limitation (IFL)

THE NEXT PROGRESSION FROM SNORING IS SLEEP APNEA

RHINITIS & SLEEP APNEA

- Apnea is a Greek word meaning “without breath.”
- Three types: central, obstructive and mixed.
- Obstructive sleep apnoea is the most common type of apnoea and is characterised by holding the breath from collapse of the upper airways during sleep.

RHINITIS & SLEEP APNEA

- Can occur five to fifty times per hour.
- Each breath hold can range from a few seconds to over one minute, causing one's blood oxygen saturation to decline to as low as 50%.

RHINITIS & SLEEP APNEA

- "There are athletes everywhere who have sleep apnea".
- "Not only does the apnea affect their athletic performance, but it is extremely hard on their cardiovascular systems as well."

- *W. Christopher Winter, M.D., medical director of the Martha Jefferson Hospital sleep medicine center in Charlottesville, Virginia*

RHINITIS & SLEEP APNEA

- Though heart-related deaths from untreated sleep apnea usually occur during sleep, chronic stress on the heart can leave victims vulnerable during strenuous athletic events.

RHINITIS & SLEEP APNEA

- "Athletes' hearts are pushed by their sport during the day and by their apnea at night," says Dr. Winter. "A time for rest and recovery now becomes a time that puts their health in peril.”

RHINITIS & SLEEP APNEA

- The prevalence of sleep-disordered breathing among all professional football players to be 14 percent overall and 34 percent within the high-risk group. (Offensive and defensive linemen)

- *N Engl J Med 2003; 348:367-368*

ASTHMA & SLEEP APNEA

- Approximately 74% of asthmatics experience nocturnal symptoms of airflow obstruction secondary to reactive airways disease.

- *Bonekat HW, Hardin KA, Severe upperway airway obstruction during sleep. Clin Rev Allergy Immunol. 2003 Oct;25(2):191-210*

ASTHMA & SLEEP APNEA

- 88% of patients in the severe asthma group, 58% of patients in the moderate asthma group, and 31% of patients in the controls without asthma group had more than 15 apnoeic events per hour.

- *Julien JY, Martin JG, Ernst P, Olivenstein R, Hamid Q, Lemi?re C, Pepe C, Naor N, Olha A, Kimoff RJ.Prevalence of obstructive sleep apnea-hypopnea in severe versus moderate asthma. J Allergy Clin Immunol. 2009 Aug;124(2):371-6. Epub 2009 Jun 26.*

RHINITIS & SLEEP APNEA

- During sleep upper airway resistance was much higher while breathing orally. In addition, obstructive (but not central) apnoeas and hypopnoeas were profoundly more frequent when breathing orally (apnoea-hypopnoea index 43+/-6) than nasally (1.5+/-0.5).

- *Fitzpatrick MF1, McLean H, Urton AM, Tan A, O'Donnell D, Driver HS. Effect of nasal or oral breathing route on upper airway resistance during sleep. Eur Respir J. 2003 Nov;22(5):827-32.*

RHINITIS & SLEEP APNEA

- Study was to determine the effect of acute nasal obstruction on sleep and breathing in eight normal persons. The subjects were randomized into two groups. One night the subject was studied with the nose open and a second night with the nose obstructed.

- Olsen KD, Kern EB, Westbrook PR. **Sleep and breathing disturbance secondary to nasal obstruction.** Otolaryngol Head Neck Surg. 1981 Sep-Oct;89(5):804-10.

RHINITIS & SLEEP APNEA

- The subjects with the nose obstructed awoke more often, had a greater number of changes in sleep stage, and spent a greater amount of time in stage I (light sleep).
- Olsen KD, Kern EB, Westbrook PR. **Sleep and breathing disturbance secondary to nasal obstruction.** Otolaryngol Head Neck Surg. 1981 Sep-Oct;89(5):804-10.

RHINITIS & SLEEP APNEA

- Acute nasal obstruction increased the number of partial and total obstructive respiratory events (obstructive hypopnea and obstructive apnea). Sleep apnea developed in one subject during this study merely on the basis of acute nasal obstruction.

- Olsen KD, Kern EB, Westbrook PR. **Sleep and breathing disturbance secondary to nasal obstruction.** Otolaryngol Head Neck Surg. 1981 Sep-Oct;89(5):804-10.

STUDIES

- 30 Patients with ≥5 events hourly but <15 hourly on the apnea-hypopnea index (AHI) were enrolled. All patients slept with their mouths closed by using the tape.

- *Huang TW, Young TH Novel porous oral patches for patients with mild obstructive sleep apnea and mouth breathing: a pilot study. Otolaryngol Head Neck Surg. 2015 Feb;152(2):369-73.*

STUDIES

	Before POP	Using POP
• ESS	8.1 ± 1.5	5.2 ± 1.6
• VAS	7.5 ± 2.0	2.4 ± 1.4

- The median AHI score was significantly decreased by using a POP from 12.0 per hour before treatment to 7.8 per hour during treatment (P < .01).
- (Median AHI reduced by 33% just by closing mouth!)
- *Huang TW, Young TH Novel porous oral patches for patients with mild obstructive sleep apnea and mouth breathing: a pilot study. Otolaryngol Head Neck Surg. 2015 Feb;152(2):369-73.*

GETTING A BETTER NIGHT'S SLEEP

Low BOLT and mouth breathing contribute to the following:

- Snoring, Sleep apnoea
- Disrupted sleep
- Nightmares
- Asthma symptoms (3am-5am)
- Needing to use the bathroom at about 6am
- Fatigue first thing in morning
- Dry mouth upon waking
- Symptoms upon waking- blocked nose, wheezing, coughing or breathlessness

GETTING A BETTER NIGHT'S SLEEP

- Avoid blue light – smart phone and laptop
- Sleep in a cool and airy bedroom
- Don't eat late at night or drink alcohol
- Switch to nasal breathing permanently
- Practise breathing softly for twenty minutes before sleep- parasympathetic NS
- Sleep on side or tummy (not back)

GETTING A BETTER NIGHT'S SLEEP

- Nasal dilator MuteSnoring
- Tape mouth closed- LipSealTape.com
- Provide each student with tape
- Demonstrate how to apply it
- Wear tape for twenty minutes during the day to become comfortable with it
- If mouth naturally moist in the morning, no need for tape