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Breathing versus voice and its correct emission

Oddychanie a głos i jego prawidłowa emisja

Keywords: breathing, voice, voice emission

Słowa kluczowe: oddychanie, głos, emisja głosu

Abstract

The formation of a correct voice requires, among other things, a proper vocal emission technique, which consists of the correct way of breathing, phonation and articulation, their mutual coordination and the correct functioning of the resonance spaces. The task of the breath in correct emission is to enliven and sustain the sound, giving it strength and fullness of tone or, on the contrary, gentleness and softness. Correct breathing is the best massage for the vocal folds because the respiratory muscles, the muscles of the larynx, pharynx and oral cavity are closely interdependent. If the respiratory muscles are impaired, the laryngeal muscles will show increased tension and excessive effort. Breathing is essential for sound production because without air movement, phonation would not be possible and there would be no environment for the sound wave to propagate. The aim of this article is to draw attention to the importance of breathing for correct vocal emission and to point out both the determinants (characteristics) of correct breathing and the breathing habits that impede correct vocal emission.

Streszczenie

Powstawanie prawidłowego głosu wymaga m.in. odpowiedniej techniki jego emisji, na którą składa się właściwy sposób oddychania, fonacji i artykulacji, ich wzajemna koordynacja oraz prawidłowa czynność przestrzeni rezonacyjnych. Zadaniem oddechu w prawidłowej emisji jest ożywienie i podtrzymywanie dźwięku, nadawanie mu siły i pełni brzmienia lub przeciwnie – delikatności i łagodności. Prawidłowy oddech jest najlepszym masażem dla fałdów głosowych, ponieważ mięśnie oddechowe, mięśnie krtani, gardła i jamy ustnej są od siebie uzależnione. Jeżeli mięśnie oddechowe będą niepełnosprawne, to mięśnie krtani wykazywać



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Data złożenia: 5.06.2023. Data przyjęcia: 14.07.2023

będą wzmożone napięcie i nadmierny wysiłek. Oddychanie jest niezbędne do wydobycia dźwięku, ponieważ bez ruchu powietrza nie byłaby możliwa fonacja i nie byłoby środowiska dla rozchodzenia się fali akustycznej. Celem artykułu jest zwrócenie uwagi na znaczenie oddychania dla prawidłowej emisji głosu oraz wskazanie zarówno wyznaczników (cech) właściwego oddychania, jak i nawyków oddechowych utrudniających prawidłową emisję głosu.

*Breath is the first thing we get at birth and the last thing we give before we die. It is so simple that it seems meaningless. And yet it is the most important.*¹

Miriam Dubini

Introduction

Being a reflex action independent of the human will and managed by the respiratory centre located in the medulla oblongata, breathing is a phylogenetically older activity than phonation since its task is to sustain life by supplying oxygen to the body's tissues, which are unable to function without it. The biological task of breathing is to sustain the homeostasis of partial pressures of oxygen (pO), carbon dioxide (pCO) and acid-base balance [Obrębowski, 2008, pp. 22–23].

Immediately after birth, a healthy baby begins a lifelong breathing cycle: ... inspiration → short suspension → expiration → short suspension → inspiration... [Ciecierska-Zajdel, 2020, p. 32].

From a biomechanical point of view, breathing is a complex activity involving muscle groups that, beside their respiratory function, are also responsible for body posture and stabilisation. Proper breathing is an essential element of physical and mental health. Breathing can calm a person down, reduce stress, improve one's performance and physical fitness [Wasilewski, 2002; Weller, 2004; 2012; Walencik-Topiłko, 2016]. In addition, correct and conscious breathing helps manage pain and improve the ability to concentrate.

A person takes 16–20 breaths per minute, which amounts to an average of 25,000 breaths per day and almost 10 million breath cycles per year [Ciecierska-Zajdel, 2020, p. 32].

The body's supply of oxygen, which is essential for metabolic processes, is provided by the so-called static breathing. Breathing is also of great importance for voice production. In breathing, called dynamic breathing this time, the inhaled air also oxygenates the body, but in addition to this it has the supplementary function of creating sound: speech or singing [Ciecierska-Zajdel, 2020, p. 32].

¹ Translation R.M-F.

The aim of this article is to draw attention to the importance of breathing for correct voice emission and to point out both the determinants (features) of correct breathing and the breathing habits which impede correct voice emission.

The importance of breathing for correct vocal emission

The task of the breath in correct emission is to enliven and sustain the sound, giving it strength and fullness of tone or, on the contrary, gentleness and softness [Okrasa, 1987, p. 60]. Correct breathing is the best massage for the vocal folds and it is mainly what determines their health [Okrasa, 1987, p. 59]. Correct dynamic breathing, using the activity of all respiratory muscles, is a process that enables the laryngeal muscles to function properly [Wysocka, 2015, p. 609].

According to Grażyna Okrasa, “the respiratory muscles, the muscles of the larynx, pharynx and oral cavity are closely interdependent [...] if the respiratory muscles are impaired, the laryngeal muscles will show increased tension and excessive effort” [Okrasa, 1987, p. 60 – translation mine]. The activity of speaking depends on breathing, in which the lungs, bronchi, trachea, larynx, epiglottis, diaphragm and the abdominal and intercostal muscles work together.

Breathing is essential for sound production as without air movement, phonation would not be possible and there would be no environment for sound waves to propagate [Tarasiewicz, 2011, p. 41].

Controlling the moment of inspiration by means of a noiseless, free intake of air is extremely important in voice emission as the opening of the larynx and the ability to support the sound correctly will depend on it [Sipowicz, 2009, p. 70].

Controlled breathing is essential for the speech process as it forms not only the basis for the correct speaking technique [Walencik-Topiłko, 2009, p. 13] but also for providing the body with sufficient oxygen and free use of the entire respiratory apparatus [Minczakiewicz, 1992, p. 31]. This is because the extent to which a person can control their own vocal emission depends on their breathing skills. Modification of the breathing pattern, lengthening of the expiration and deepening of the inhalation makes it possible to release optimal vocal capabilities with minimal fatigue of the vocal apparatus [Walencik-Topiłko, 2016, pp. 282, 283].

Breathing using breath support² has an impact on all voice emission activities, particularly on the functioning of the vocal folds, contributing significantly to the prevention of voice disorders. The quality of the breath determines the energy that can be used for sound shaping [Rokitiańska, Laskowska, 2003, p. 42].

It should be noted that in addition to an appropriate voice emission technique which consists of correct breathing, phonation and articulation, their mutual coordination

² The concept of breath support will be explained later in the article.

and correct functioning of the resonance spaces, correct voice formation also requires correct morphology, function of the larynx and the nervous system [cf. e.g. Wiskirska-Woźnica, 2006].

Determinants of correct breathing for appropriate voice emission

The correct manner of breathing is important for voice creation. The following is meant when speaking of the correct way of breathing:

Breathing with a short and silent inspiratory phase using free air intake

Inhalation in dynamic breathing should be fast and soundless (murmurs during inspiration are a symptom of excessive laryngeal tone or laryngeal blockage).

Voice educators tend to argue that the depth of inhalation is not as important as how the air which is stored is used. It is essential that the exhaled air stream has a similar pressure over a long period of time, which enables a strong, full voice to be created even in a very long phrase. During static, uncontrolled exhalation, the pressure of the exhaled air gradually decreases yet it must remain at a similar level for a longer period of time when speaking and singing [Ciecierska-Zajdel, 2020, p. 38].

The most effective type of breathing

Holistic breathing (also known as costal-abdominal, costal-diaphragmatic-abdominal, diaphragmatic, full, diaphragmatic-pelvic, lower, lower costal, abdominal-diaphragmatic, thoracic-abdominal or total breathing [Oczkoś, 1999]) is the most effective type of breathing. All respiratory muscles take part in it. A person is able to introduce the greatest possible amount of air into the lungs, not stiffening the chest and not creating unnecessary tension in the shoulder, neck or nape area [Tarasiewicz, 2011; Ciecierska-Zajdel, 2020; Śliwińska-Kowalska, Niebudek-Bogusz, 2009]. Cf. Table 1.

Table 1. Type of breathing and lung capacity

Breathing type	Men	Women
Clavicular	2150 cm ³	2000 cm ³
Costal	2680 cm ³	2170 cm ³
Diaphragmatic	3200 cm ³	2540 cm ³
Holistic	3960 cm ³	2700 cm ³

Source: Tarasiewicz, 2011, p. 134, cf. also Brégy, 1974, p. 54

This type of breathing is considered the best for phonation when it allows the best parameters to be obtained. It is also recommended as a healing breath as it greatly improves the ventilation of the pulmonary alveoli (oxygenation of the body), decreases

the rate of breathing (which has an impact on lowering the heart rate) and reduces the amount of air that accumulates in the lungs [Tarasiewicz, 2011, p. 50].

According to Wiktor Brégy, the most favourable breathing type is “completely natural since it functionally corresponds fully to a normal physiological inhalation, with balanced use of the entire lung volume and unrestricted movement of the respiratory muscles” [Brégy, 1974, p. 53].

Agata Szkiełkowska and Ewa Kazanecka propose, on the other hand, that when using the voice at a lower volume, care should be taken above all to use diaphragmatic breathing since the reduced amount of air inhaled in this way is sufficient for proper phonation and the pressure in the abdominal cavity will not increase to such an extent as to cause tension in the laryngeal region [cf. Szkiełkowska, Kazanecka, 2011, p. 41].

In summary, it is worth stressing that holistic breathing has the following characteristics [Okrasa, 1987; Maksymowicz, 2003; Tarasiewicz, 2011]:

- 1) it is the most beneficial, efficient and hygienic of all breathing types;
- 2) this breathing type provides the body with the greatest amount of air and hence oxygen;
- 3) it involves all parts of the lungs (but with no visible shoulder elevation);
- 4) it expands the thorax in the longitudinal, lateral and anteroposterior directions while immobilising its upper clavicular part;
- 5) a strong diaphragm muscle pushes the air upwards with great efficiency and the lower ribs in the lateral-tibial part spread out to the sides, slightly lifting upwards;
- 6) the diaphragm area and abdominal muscles remain relaxed and unstiffened but still ready to work;
- 7) a slight anterior protrusion of the abdominal wall can be observed when the diaphragm is lowered;
- 8) inhalation should be fast, soundless, flexible and relaxed, performed with an open mouth;
- 9) it is important not to create unnecessary tension in the abdominal and chest muscles when breathing holistically.

Developing such a breathing habit as well as controlling the holistic breath and regulating it properly (breath support) is a prerequisite for correct voice production [Rokitiańska, Laskowska, 2003, p. 41]. Correct breath support makes it possible to regulate the sub-glottis pressure and to use air economically [Sobierajska-Friedrich, 1970, p. 16].

Conscious use of breath support

In addition to holistic breathing, which is the most favourable for voice emission, it is also important to consciously use the aforementioned so-called breath support, or *appoggio*, which consists of diaphragmatic support involving keeping the diaphragm

in costal breathing in an inspiratory position for about eight seconds after the start of phonation, and thoracic support involving keeping the chest in ventral breathing in an inspiratory position when the diaphragm is already starting to move upwards [Kittel, after: Obrębowski, 2008, p. 25].

The supports were used for the breath support technique (*appoggio*), which involves consciously slowing down the expiratory phase by means of a controlled tension of the inspiratory muscles. This results in a unique phenomenon of the simultaneous activity of both the inspiratory and expiratory muscles, i.e. during expiration the thorax remains in the inspiratory position and the abdominal diaphragm loses its tension slowly, gradually lifting upwards [Mitrinowicz-Modrzejewska, 1971]. This tension of the inspiratory muscles, with simultaneous activation of the expiratory muscles, lasts for about eight seconds³. Due to this technique, the expiratory phase is effectively extended by maintaining an inspiratory posture while relaxing the diaphragm. In breath support, the external intercostal muscles and the serratus anterior muscle play an essential role in prolonging the inspiratory position of the thorax since the diaphragm interacts in a sense with the expiratory muscles while relaxing indirectly. Breath support involves active control of the exhalation. In addition to respiratory muscle tension, subjective sensations connected with breath support include a feeling of subglottic air pressure and accompanying paresthesia in the throat and the oral cavity [Obrębowski, 2008, p. 25; 2019, p. 36].

The sensation of breath support is reminiscent of coughing or sneezing. When the air being pushed out lacks breath support, it is difficult to produce a resounding sound and a long exhalation phrase. The voice then tires quickly and is prone to developing a variety of disorders [Wosik-Kawala, 2015].

As Ewa Binkuńska argues:

The ability to use breath support permits the use of the voice without experiencing the discomfort of speech fatigue. In turn, failure to master this technique may result in trembling and faltering of the voice, tightening of the throat muscles [...], inability to freely control dynamics and resonance, and unclear articulation. [...] The lack of adequate breath support also leads to a perceptible lack of air during prolonged speech, resulting in frequent and aesthetically unpleasant inhalation of more air at inappropriate points in the spoken phrase. The speech itself then acquires the character of being nervous and unpleasant to the ear at the same time [Binkuńska, 2012, pp. 82–83].

The basis of breath support is that the respiratory muscles should be flexible without becoming stiff. Keeping the chest in the inhalation position but while exhaling, must not be done at all costs. Understanding this will allow conscious and tension-free

³ Breath support, or simultaneous tension of the inspiratory and expiratory muscles lasts for approximately eight seconds from the start of phonation according to Mitrinowicz or by the end of phonation according to Klein [Sielska-Badurek, Domeracka-Kołodziej, 2009, p. 111].

control of exhalation air. Breath support to be directly proportional to sound intensity [Kołodziej, 2014, p. 55].

Simultaneous work of both muscle groups requires extraordinary harmony and dosing tension with precision, which is often only possible after a long period of voice training [Sielska-Badurek, Domeracka-Kołodziej, 2009, p. 111].

Breathing with the correct airway

In static breathing, which does not serve the purpose of speaking, air intake should be through the nose, whereas in dynamic breathing (speaking and singing), inspiration is usually through the nose or simultaneously through the nose and mouth: the latter is preferred for speaking⁴.

Regular breath in the case of static breathing, where inspirations follow one another at equal intervals, with a prolonged expiratory phase, whereas in the case of dynamic breathing

In static breathing, the inhalation and exhalation phases are of almost equal length (1: 1.1 to 1: 1.5), air consumption is low (approx. 0.5 l), breathing is shallow and automatic. In dynamic breathing, inhalation is much shorter than exhalation (1: 3 to 1: 7), the number of breaths per minute decreases and the volume of air inhaled increases to several litres [Wiskirska-Woźnica, 2006, p. 72].

Steady, calm, unhurried breathing

Respiratory rate norms in a healthy person depend on age. The normal respiratory rate in a newborn baby is about 40 breaths per minute, in children about 20–25 breaths per minute and in an adult 16–20 breaths per minute.

Rapid and shallow breathing is a natural defensive response of the body which should occur in a situation of danger or during escape. Short, rapid breathing can also indicate internal tension. Accelerated breathing is said to occur when it exceeds 20 breaths per minute.

Breathing without straining the muscles of the neck, trunk and limbs (during resting and dynamic breathing) [Wysocka, 2015]

Stiffening of the chest, incorrect posture, hunching, and tension caused by stress impede voice emission.

When analysing the mistakes made during breathing work, the problem of the balance between the tension and relaxation of the respiratory muscles comes to the fore [cf. Sobierajska, 1972, p. 49]. It is the achievement of balance that is supposed to prevent tension and stiffness in other areas of the body.

⁴ However, there are situations (singing or intense speech) that the only way to take in air quickly is to breathe through the mouth (as this provides more air in a short time).

Breathing inducing patient comfort when performing breathing activities at rest and while speaking (singing) [Wysocka, 2015]

Speaking of breathing, one should not forget about coordination of breathing, phonation and articulation. This function, as Marta Wysocka notes, is achieved through the cooperation of the muscles involved in breathing, phonation and articulation. It is a prerequisite for good voice quality when speaking and for the correct realisation of segmental and suprasegmental elements of speech [Wysocka, 2015, p. 610]. The following will be important here:

1. Adjusting the air intake to the voice task – it is about taking in the right amount of air for the voice task. If too little air is taken, the patient's speech is often interrupted by inhalation.
2. Not speaking during inspiration.
3. The correct timing of phonation of the vowel [a] – we study the uninterrupted phonation (on one exhalation) of the vowel [a] after taking a deep breath. The result is the average of three attempts. The correct phonation time is 20–25 seconds (40 or even up to 60 seconds in singers). A phonation time of less than 10 seconds is considered abnormal.
4. Not speaking on residual exhalation.
5. Appropriate length of a phrase uttered on one breath.

Using a single exhalation, one should be able to say the whole of a longer phrase [cf. Wysocka et al., 2008].

Breathing habits which impede correct voice production

In addition to the determinants of correct breathing, the literature of the subject lists examples of breathing habits which hinder correct voice emission. These include:

- 1) inhalation which is too long, loud or wheezing (it should be quick and fairly silent) [Mielnik, 2010; cf. also Wojtyński, 1970];
- 2) expelling all air too quickly with the aim of prolonging the exhalation phase [Mielnik, 2010];
- 3) excessive expansion and upward lifting of the entire chest, which causes abdominal muscle contraction and neck tension [Kozłowska, 2016; cf. also Wojtyński, 1970; Okrasa, 1987; Mielnik, 2010];
- 4) stiffening of the abdominal muscles most often in search of strong support, causing immobilisation of the abdominal wall [Kozłowska, 2016; cf. also Okrasa, 1987];
- 5) maximum abdominal retraction during support resulting in stiffening of the abdominal muscles and immobilisation of the thorax [Kozłowska, 2016; cf. also Okrasa, 1987];
- 6) simultaneous stiffening of the chest and deeper abdomen [Kozłowska 2016; cf. also Wojtyński, 1970; Okrasa, 1987];

- 7) expansion of the thorax in the front part, with the back muscles remaining immobile and not involved in breathing [Kozłowska, 2016; cf. also Okrasa, 1987];
- 8) flaccidity of the abdominal wall below the umbilicus causing significant stiffening of the thorax due to the tendency of other muscles to compensate for the lack of support and involving, as secondary movements, stiffening of the neck and jaw muscles [Kozłowska, 2016; cf. also Wojtyński, 1970; Okrasa, 1987];
- 9) excessive inflation of the diaphragm, which leads to unnecessary tension: the whole chest must work and the diaphragm cannot be immobilised by ‘pushing out the abdomen’ [Mielnik, 2010];
- 10) constant shortening of the breath: stiffening of the thorax and its excessive mobilisation for action limits the mobility of the lower ribs while the mobility of the diaphragm is limited by incorrect postural habits and excessive stiffening of the legs as well as the pelvic and abdominal region [Kędzior, 2006];
- 11) holding one’s breath: stress and excessive ‘trying’, which are often combined with holding one’s breath, limit one’s vocal capacity the most [Kędzior, 2006];
- 12) stiffening of the posture when inhaling, slumping of the posture when exhaling; it is very common to observe a habit of lifting the chest and shoulders upwards (with an accompanying stiffening of the whole posture) during inhalation and relaxing (reminiscent of drooping) and leaning in during exhalation; this tendency is amplified when one wishes to take a deeper breath; the effect, however, is the opposite; the stiffening of the thorax results in relatively little air entering the lungs, and the drooping on exhalation causes the lungs to empty with increased kyphosis of the thoracic spine rather than through the work of the lower ribs and the diaphragm [Kędzior, 2006];
- 13) faulty posture (e.g. twisting the head sideways or tilting it back while pulling the chin forward; hunching; unstable posture; significant strain on the lumbar spine) [Sipowicz, 2009].

Conclusion

Correct breathing is the basis for good voice emission in speaking and singing. This is because the way in which a person breathes influences all emission activities, including the functioning of the vocal folds.

The breathing process consists of two phases: inhalation and exhalation, during which the diaphragm, the lungs and the abdominal and intercostal muscles work together. The process of breathing and the muscular movements that accompany it are innate, whereas the movements of the same muscles when producing sounds are learnt [cf. e.g. Stachowski, 2015].

In static (resting) breathing, one breathes shallowly and automatically. In this type of breathing, inspiration is an active process, requiring contraction of the inspiratory

muscles. Exhalation, on the other hand, is a passive process in which muscle tension is relaxed. This type of respiration takes place on an unconditioned reflex basis to satisfy the vital function of gas exchange and requires little muscular effort [Sielska-Badurek, Domeracka-Kołodziej, 2009, p. 111].

In dynamic breathing, i.e. breathing in emission (speaking and singing), inhalation is shortened but at the same time deepened while exhalation is prolonged. Exhalation is no longer a passive process, but an active one, enabled by the work of various muscle groups. Dynamic breathing skills are improved through training, which allows the exhalation phase to be prolonged and the air to be managed more adequately [Sielska-Badurek, Domeracka-Kołodziej, 2009, p. 111].

An inspiration inhaled correctly does not create unnecessary tension in the body, and a correct exhalation is even and consciously controlled [Ciecierska-Zajdel, 2020, p. 39].

Grzegorz Kołodziej suggests experimenting with the phonatory flow. Control over lengthening, pausing, accelerating, decelerating, selecting and dosing its intensity based on one's own feelings will allow for a free and natural use of the voice [Kołodziej, 2014, p. 56].

Awareness of the characteristics of correct breathing and the elimination of breathing habits makes it possible to work on correct voice emission.

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